

Prepared for:  
United States Steel Corporation  
Clairton Plant  
Clairton, PA 15025

# Installation Permit Application for the Proposed C Battery Project

ENSR Corporation  
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## 1.0 Introduction

### 1.1 Project Overview

The United States Steel Corporation, Clairton Plant operates 12 coke batteries at full capacity utilization produces up to 13,000 tons of coke per day from the destructive distillation (carbonization) of more than 18,000 tons of coal. During the carbonization process, approximately 225 million cubic feet of coke oven gas are produced. The volatile products of coal contained in the coke oven gas are recovered in the by-products plant. In addition to the coke oven gas, daily production of these by-products include 145,000 gallons of crude coal tar, 55,000 gallons of light oil, 35 tons of elemental sulfur, and 50 tons of anhydrous ammonia.

Clairton Plant is located approximately 20 miles south of Pittsburgh on 392 acres along 3.3 miles of the west bank of the Monongahela River. The plant was built by St. Clair Steel Company in 1901 and bought by U.S. Steel in 1904. The first coke batteries were built in 1918. The coke produced is used in the blast furnace operations in the production of molten iron for steel making. Most of the coke is used by sister plants with a portion sold in the commercial market.

The Clairton Plant is a major source of CO, NO<sub>x</sub>, PM, PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, VOCs and Hazardous Air Pollutants (HAPs). The emission sources at the plant can be divided into four general categories

- Coke oven batteries and related equipment
- Coke By-Products and Desulfurization Plant
- Coal and coke handling facilities
- Miscellaneous facilities

United States Steel is proposing two projects that will replace some of the old coke oven batteries with new batteries. In the first project a new C Battery will replace existing Batteries 7 - 9. In the second project a new D Battery, (subject of a separate permit application), will replace Batteries 1 - 3. The new batteries will contain the latest emission control technology and will emit less air pollution per ton of coal charged and per ton of coke produced than the old batteries. The project will reduce total emissions at the facility. Due to the emission reductions, the projects will not trigger review under the Prevention of Significant Deterioration (PSD) regulations and Nonattainment New Source Review (NNSR).

### 1.2 The Applicant

The Applicant for this Project is United States Steel Corporation, Clairton Plant. The primary contact person with overall responsibility for the Project and this Application is:

Lisa Roudabush

General Manager

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The applicant retained ENSR Corporation to prepare this application and perform supporting analyses. The primary contact person at ENSR responsible for preparation of this document is:

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The Project will require an Installation Permit from the Allegheny County Health Department (ACHD). This document constitutes the permit application for the C Battery Replacement Project. **Section 2** of this document contains a detailed project description. **Section 3** presents a regulatory review, including a demonstration that the Project will not trigger review under the PSD regulations and will not trigger NNSR for PM<sub>2.5</sub> and ozone. **Section 4** presents the Best Available Control Technology (BACT) analysis for the new C Battery. The following appendices are included:

- Appendix A Allegheny County Health Department (ACHD) Installation Permit Forms
- Appendix B Process Flow Diagrams, Site Layout Drawings and Project Specification Sheets
- Appendix C Emission Calculations
- Appendix D Literature on the PROven® System
- Appendix E Best Available Control Technology (BACT) Backup
- Appendix F Fugitive Dust Control Plan
- Appendix G ACHD Permits List
- Appendix H U.S. Steel Compliance History
- Appendix I Modeling Results

## 2.0 Project Description

### 2.1 Overview

United States Steel Corporation plans to replace existing Batteries 7, 8, and 9 at its Clairton Plant with a new C Battery. The Project will result in a return to full production of coke while using less coke oven gas (COG) in the coking process. The table below shows past actual coal charged, COG consumed and coke produced for Batteries 7 - 9. The table compares these values with design values for C Battery. C Battery will produce more coke than currently produced on Batteries 7 - 9 while using approximately 11% less COG. A reduction in the amount of coke oven gas burned, fewer but larger ovens and installation of a low NO<sub>x</sub> heating system will result in lower air pollutant emissions from COG combustion.

**Comparison of Batteries 7 - 9 and Proposed C Battery Coke Production**

|                        | <b>Batteries 7 – 9<br/>(Current Actual during<br/>comparison time period)</b> | <b>C Battery<br/>(Future Potential)</b> |
|------------------------|---|---|
| No. Ovens              | 192   | 84                                      |
| Coal Charged (TPY)     | 1,229,551   | 1,379,059                               |
| Coke Produced (TPY)    | 896,421   | 1,107,384                               |
| COG Consumed (MMcf/yr) | 6690.00   | 6,123.2                                 |

The new C Battery will be located adjacent to but slightly south of the existing B Battery. The site layout in Appendix B shows the proposed location of C Battery. C Battery will utilize existing coal unloading, handling and conveying equipment. Coke produced from C Battery will be sent a new coke screening station for rail car loading and offsite transport. Minor modifications will be made to a new coke screening station to accommodate load out for an additional rail car.

Clairton Plant is located in a special PM<sub>2.5</sub> non-attainment area. The area is also designated as a nonattainment area for the 8-hour ozone standard and is within the Northeast Ozone Transport Region (NOTR). The Pennsylvania Department of Environmental Protection (PADEP) has submitted a request to the EPA to re-designate the Project area as attainment for the 8-hour ozone standard. For air permitting purposes, Allegheny County is treated as a moderate ozone nonattainment area. This Project will significantly reduce direct PM<sub>2.5</sub> emissions as well as reduce emissions of SO<sub>2</sub> and NO<sub>x</sub> at Clairton, which are precursors to PM<sub>2.5</sub>. Emissions of VOC and NO<sub>x</sub>, which are precursors to ozone, will also be reduced. Emissions of CO and hazardous air pollutants (HAPs) will be reduced as well.

Emission reductions at the plant will be accomplished through two means: more efficient emissions control technology on C Battery and a more efficient coking process that requires less coke oven gas to be burned per ton of coal charged and ton of coke produced. A low NO<sub>x</sub> heating system will be installed for burning COG during coking. C Battery will more effectively capture coke oven pushing emissions through use of a hood integrated with the door machine. Hot car quenching emissions will be reduced by a highly efficient dual baffle system and a taller quench tower that provides greater draft.

As part of the C Battery Project, United States Steel will install the PROven® system, developed by Uhde Corporation, the engineer for this project. The PROven® system (Pressure Regulated Oven) regulates pressure within each oven chamber where the collector main operates under a negative pressure during coking in order to almost eliminate fugitive emissions from the ovens during charging and coking.

The three existing underfire (or combustion) stacks are the largest sources of SO<sub>2</sub>, NO<sub>x</sub> and CO in Batteries 7 - 9 and the third largest emitters of particulate matter. In C Battery there will be only 84 ovens compared to the 192 ovens in Batteries 7 - 9. Although the C Battery ovens will be larger and the amount of coke produced higher than current levels, the amount of coke oven gas burned in C Battery will be 11% less per ton of coal charged due to better combustion efficiencies with the larger ovens.

## **2.2 Comparison of Batteries 7-9 with C Battery Emission Controls**

The following text presents a comparison of operations and emissions controls for Batteries 7 - 9 and C Battery.

### **2.2.1 Coal Handling**

The general procedure for coal handling involves the transfer of coal from barges or trucks onto several conveyor belts which in turn transfer the coal into mixing bins or surge bins where the coal is stored until needed in the process. Figure B-2 in Appendix B is a flow diagram of the process. As required, the coal is transported from the surge bins into pulverizers where it is pulverized to a pre-selected size after which it is blended with a wetting agent (oil or water) to regulate the bulk density of the mixture. This mixture is stored in bunkers until a larry car picks up a specific mass (or volume) of the mixture before charging it to the ovens.

Coal is delivered presently to Clairton Plant via barges and trucks.

1. Coal from barges is unloaded using a 3-strand unloader, consisting of 47 buckets each, into an apron feeder. The apron feeder delivers the coal to a conveyor (conveyor No. 12A) which in turn delivers the coal to another conveyor (12C).
2. The coal from storage is loaded into trucks which deliver the coal to a hopper feeding a conveyor (12B) which in turn transfers the coal onto conveyor 12C.

The coal from both means (barges and trucks) finally meets at conveyor 12C after which conveyor 12D receives and transfers the coal onto shuttle conveyors 12E and 12F. Conveyors 12E and 12F are movable conveyors which drop the coal into four silos intended for storing coal.

Each silo is equipped with two weigh belt feeders. The weigh belt feeders on the east deliver a weighed mass of coal onto conveyor 12K. Conveyor 12K delivers the coal into the primary pulverizer for Batteries 1 - 3 and 7-9. The pulverized coal drops onto a reversing conveyor 12U which transfers the coal onto conveyor 1A which then transfers the coal onto 1B.

From conveyor 1B, the coal splits into two streams; the first stream goes onto shuttle conveyor 1C to the coal bunkers for Batteries 7, 8 and 9. The second stream goes onto conveyor 1D which transfers it to shuttle conveyor 1E. Shuttle conveyor 1E discharges the coal into bunkers for Batteries 1, 2 and 3.

The west weigh belt feeder conveys the coal to conveyor 12P, which delivers it to conveyor 12S. Conveyor 12S discharges the coal into a secondary pulverizer which pulverizes coal for the feed stream to the B Battery. The pulverized coal is transferred to the B Battery coal bunkers using seven different conveyors.

It is worthwhile to note that barring the conveyors 1A, 1B, 1C, 1D and the coal bunkers for Batteries 1 - 3 and 7-9, all the equipment is enclosed signifying controlled emission points.

The C Battery project will not include any new coal handling equipment or any modification to the existing equipment. However, the shutdown of Batteries 7 - 9 will result in a significant reduction in the mass of coal conveyed to conveyors 1A, 1B, 1D, 1E and the existing coal bunkers used by Batteries 7 - 9.

New conveyors shall be installed to transport coal from the primary pulverizer to the C Battery and D bunkers (C and D will share a set of bunkers). These new conveyor will also be enclosed. Fugitive dust emissions from coal handling are expected to increase slightly as a result of increased use of coal.

### 2.2.2 *Charging Coal to Ovens*

The Clairton Plant operates 12 by-product coke oven batteries. By-product coke ovens are designed and operated to permit collection of the volatile material evolved from coal during the coking process. Each battery contains from 61 to 87 ovens. Coal is charged through openings in the top of the ovens. Emissions from the coke batteries during coal charging are controlled by:

- volumetric controls to ensure the proper amount of coal is charged to the oven (extra coal would block gas passages);
- stage charging, wherein not all of a larry car's hoppers are emptied at once so the exhaust system is not overwhelmed; (Larry cars receive coal from coal storage bins and are equipped with four hoppers that discharge a measured volume of coal to the oven. They move along rails on top of the battery.)
- currently in Batteries 7 - 9, steam aspirators are used in the battery offtakes to create exhaust suction to draw emissions into the collecting main;
- automatic lid lifters, where available, on newer batteries minimize the time that lids remain open;
- dual collector mains on existing Batteries 7 - 9, and
- after charging is completed, the charging holes are lidded and sealed and steam aspirators are turned off.

Batteries 7 - 9 operate as follows. A specific amount of coal (stored in the coal bunkers) is discharged from the bunker into a larry car. A larry car is an electrically operated vehicle that is capable of carrying the coal over the entire length of the battery. The process of charging begins with the positioning of the larry car over the coke oven, known as spotting. At this time, the lids on the charging ports are removed and coal is dropped from the larry car into the oven.

Steam aspiration is used to suck the gases generated in the oven chamber into the collector mains, thus reducing charging emissions. Once the larry car has passed over and dropped coal into the oven chamber, a leveling bar evens the coal out to create a uniform free space above the coal charge. This assists in the unobstructed flow of offtake emissions through the collector main to the by-product plant. In the case of Batteries 7 - 9, the ovens are maintained at a slight positive top pressure throughout the coking cycle due to the rapid evolution of gas, which may result in charging emissions and leaks from doors and lids.

With the installation of C Battery, a screw feed larry car will allow for more controlled charging of coal into the ovens. Steam aspiration will no longer be used to suck the gases into the collector main. Instead, charging emissions are expected to decrease as a result of the use of the PROven® system installed in the gas offtake of each oven system. Figure B-3 in Appendix B shows the arrangement of C Battery. The Pressure Oven Regulated system or the PROven® system is an electronic control system that individually controls the pressure in each individual oven depending on the stage of coking that each oven is experiencing. The collector main is also maintained at a negative pressure to draw the off gases released during charging and

coking thus reducing emissions. The high spikes in oven pressure currently experienced will be eliminated. A complete description of the PROven® system is provided in Appendix D.

### 2.2.3 Coking Process

Once the ovens have been charged with coal, the coking process begins. The walls of the ovens contain heating flues, of which half burn COG and the other half transport the residual heat from the combustion flues to a heat exchanger called a regenerator. The waste gases coming out of the heat exchanger are discharged from the combustion stack. The average coking time depends on oven conditions and the coke quality and quantity specifications of customers. Oven conditions can affect the ability of an oven to produce at the desired quality level at the design coking rate. At Clairton Plant, the coking time varies between 18 hours and 22 hours depending on demand as well as on oven conditions and the quality of coal being charged. The destructive distillation of coal produces raw coke oven gas, which is cleaned and used as a fuel in the heating flues. To prevent the entry of air into the oven during coking, a slight positive pressure is maintained in the oven. The by products of coking (gases) are carried through the offtake system to the byproduct recovery plant. At the conclusion of the coking cycle, the doors are removed and the incandescent coke is pushed by a ram into the hot car.

Atmospheric emissions during coking result from fugitive emissions (charging, offtakes, door and lid leaks) and from point sources (combustion stack). Emissions from soaking and decarbonization are included in the totals for the coking process as well. Soaking refers to emissions directed to the atmosphere for a short period when the oven is disconnected from the collector main just before the doors are removed in preparation of the push, i.e., the standpipe caps are opened to the atmosphere. Coke that is still "green" would emit pollutants to the atmosphere through the stand pipes. Decarbonization emissions occur after pushing and after the doors have been replaced. The lids are kept cracked or off and the oven left empty for 20-30 minutes to burn off excess wall or roof carbon.

With the installation of C Battery and the PROven® system, the leaks from doors and lids, emissions from soaking due to poor seal between the oven and collector main, and offtake leaks will be minimized since the emissions will be conveyed to the collector main which is maintained at a negative pressure. (Refer to Figure B-3 in Appendix B).

C Battery will also burn 11% less COG per ton of coke produced currently than Batteries 7 - 9. NO<sub>x</sub> emissions will be controlled using a low NO<sub>x</sub> heating system. These emission reductions are a significant part of the Project.

### 2.2.4 Pushing

The existing Batteries 7 - 9 consist of 64 ovens per battery for a total of 192 ovens. Batteries 7 - 9 use a moveable hood/fixed duct system to capture pushing emissions. The system consists of a hood that covers the quench car. The hood connects to a duct, which in turn is connected to a baghouse. Coke pushing begins when the coke side door is removed and ends when the hot car enters the quench tower. During the push, gases are drawn from the quench car into the hood where they are channeled to the exhaust duct. The fan capacities on the moveable hood/fixed duct control systems have all been recently increased which has increased their capture efficiencies.

During pushing, air pollutants can be released for a short time into the atmosphere from the open door with no hood above the door. The Pushing Emission Control (PEC) system consists of a moveable hood with a stationary baghouse (PEC BH). Batteries 7 - 9 operate with one hot car that receives the hot coke from pushing, one moveable hood placed over the hot car on the coke side of the oven and two door machines. Pushing typically occurs in the following sequence:

- The door machine removes the coke side door

- The door machine takes the door to the door cleaner in the transfer area
- The hood arrives at the open oven
- The door machine returns to the open oven and lines up the coke guide with the open oven
- The quench (hot) car arrives at the open oven
- The PEC baghouse (PEC BH) is turned on
- The pusher starts pushing coke into the hot car
- When the oven is empty (i.e., all the coke is in the hot car), the hot car moves to the quench tower and the PEC BH is turned off,
- The door machine cleans the door jamb
- The door machine replaces the door

Most of the emissions from the hot coke are captured by the hood (83.6%). These emissions are directed up through the PEC BH, controlled, and the remainder emitted to the atmosphere. The PEC BH emits SO<sub>2</sub>, NO<sub>x</sub>, PM, VOC, CO and very small amounts of other pollutants. The current PEC BH has a permitted outlet grain loading of 0.030 gr/dscf.

The emissions not captured by the hood are called PEC fugitives.

While pushing is occurring at one oven, the second door machine has moved to another oven, spotted up and gone through the door cleaning. Once pushing at the first oven has been completed, the hood slowly moves to catch up with the door machine at the second oven.

The emissions from the open oven prior to the coke mass beginning to move are part of pushing emissions. The amount of emissions to the atmosphere depends upon the amount of time the door has been removed before the hood is in place. When the hood is in place over the hot car, the PEC BH fans are turned on and coke pushing begins.

C Battery will consist of 84 larger ovens with filling dimensions of 6 meters in height x 18 inches wide (average) x 16.7 meters in length. The PEC system on C Battery will consist of a hood that is integral to the door machine (coke transfer car), thus reducing pushing fugitive emissions, that is, whenever a coke oven door is opened, there will be a hood to capture emissions. The hood's capture efficiency is guaranteed at 90%, thus also reducing PEC fugitives. The PEC BH will have an outlet grain loading of 0.005 gr/dscf.

### 2.2.5 Travel

After receiving the hot coke, the hot car travels to the quench tower. Batteries 7 - 9 all use the same quench tower. During travel the hot car is uncovered. Emissions to the atmosphere consist mainly of SO<sub>2</sub> released as part of the hot air rising from the coke in the car. Smaller amounts of particulates, NO<sub>x</sub>, CO and other pollutants are also released.

For C Battery, there will be a new hot car and quench tower. Hot car travel-related emissions will be lower than those from Batteries 7 - 9 for several reasons (see Figure B-4 in Appendix B). There will be fewer trips traveling to the quench tower. Travel distance to the C Battery quench tower will be less, resulting in fewer trip miles per year. Also, the C Battery hot car will be larger than the Batteries 7 - 9. The coke in the larger C Battery hot car will have greater surface area exposed to the atmosphere, thus higher emissions per car.



However, the larger hot car will have a smaller surface area to volume ratio, thus emitting less pollutant per volume or per ton of coke in the hot car. The net effect is lower annual emissions from C Battery traveling.

### 2.2.6 Quench Tower

Incandescent coke, after it is pushed from the ovens, is transported by means of a quench car or hot car to a quench tower. Quenching of coke minimizes it from burning from further exposure to air.

Currently, Batteries 7 - 9 use the quench tower #3. It is equipped with baffles which help capture and remove the entrained water droplets (which contain particulate matter). It is estimated that baffles control up to 87% of the PM emissions from quenching operations. It uses water from the Monongahela River as make-up which is the closest water body to the facility. Approximately 162 gallons of water are lost to evaporation during the quenching of a ton of coke.

As part of the C Battery Replacement Project, the quench tower #3 will be shut down along with the B battery auxiliary tower which will be demolished. A new quench tower (ID: P047) will be installed for the C Battery. This new quench tower will also serve as the auxiliary quench tower for the B Battery. This new quench tower will have an exit area of 1406.1 ft<sup>2</sup> and will have a height of 164.2 feet above grade. It will have Kiro-Nathaus baffles installed within it which are more efficient at capturing the entrained water droplets than the baffles in the quench tower currently being used by Batteries 7 - 9. In addition to the new quench tower, the C Battery system will employ a new quench car to transport the coke from C Battery to the new quench tower.

The quench sump for C Battery will be larger than Batteries 7 - 9 quench sump for better settling and thus cleaner recirculation water. It will also have a rake to remove the settled solids.

The Battery B quench tower (exit area = 774.7 ft<sup>2</sup> and height = 131.5 feet above grade) will serve as the auxiliary tower for quenching the coke from C Battery until the D Battery and its quench tower are built.

### 2.2.7 Coke Handling

Quenched coke is transferred from the coke wharf to one of three screening stations. No. 1 Screening Station (P034) receives coke from Batteries 1 - 3 and 7 - 9, No. 2 Screening Station (P035) receives coke from Batteries 13-15 and 19 & 20, and No. 3 Screening Station receives coke from B Battery. As part of the Project, C Battery coke will be transferred to a new screening station. No. 1 Screening Station will receive coke from Batteries 1 - 3 only as Batteries 7 - 9 will no longer be in use.

After being quenched with water, coke is discharged onto an inclined surface called the coke wharf which allows for the drainage of excess water. The heat transfer during this time also brings the coke to a lower temperature making it safe to handle. After this, the coke is transported via conveyors to screening stations where it is segregated based on size.

At present, the hot car carries the quenched coke over the wharf where the bottom doors of the hot car open up and drop the coke onto the wharf. It is assumed that the coke coming out of the quench tower contains only moisture and no particulates. The coke is held for a period on the wharf so that the moisture attached to it evaporates. The low moisture coke is conveyed off the wharf to the screening station. In the screening station, a metal screen sifts and separates the coke based on size. During this time, a surfactant is added to the coke as a dust suppressant. The large fractions, known as blast furnace coke are dropped from the screening station into a rail car while the small fractions, known as coke breeze are dropped into a bin then into a truck. Additional surfactant is mixed with the coke breeze at this time to prevent particulate emissions during transport.

In the future, the new quench car of C Battery will dump the quenched coke on the wharf where most of the moisture will be evaporated from the coke. The coke will be transferred from the wharf onto the conveyor B1

(currently being used by the B Battery) from where it will drop onto the conveyor B2 which will carry the coke to new screening station which will serve B, C, and D Battereis. This new screening station will be permitted separately and will be equipped with a new bag house (fabric filter) for particulate collection. It will also have a two track loadout (similar to No. 1 screening station). The blast furnace coke will be dropped into rail cars and the coke breeze will be dropped into trucks. Since the conveyors at the screening screening station will be enclosed, emissions of pollutants are collected and controlled. The coke breeze loadout emissions will be captured by a dedicated dust capture hood.

### **2.3 Summary of Emissions**

The **Tables 2-1 and 2-2** below present total emissions from C Battery and from Batteries 7 - 9. Emissions for C Battery are the maximum allowable at design capacity. Emissions for Batteries 7 - 9 are baseline actual annual emissions derived from a 2-year period starting May 1, 2002 and ending April 30, 2004. Emissions are presented for each pollutant and component of the processes involved in making coke. The **Tables 2-1 and 2-2** indicate that emission decreases will be achieved for most process components.

Table 2-1 Baseline Actual Emissions for Batteries 7-9, Quenching during May, 2002 through April 2004

| Actual Annual Emissions for BATTERIES 7-9 |                 |                 |           |                            |  |   |           |
|---|-----------------|-----------------|-----------|----------------------------|--|---|-----------|
| PROCESS                                   | NO <sub>x</sub> | SO <sub>2</sub> | VOC       | PM<br>TOTAL<br>(filt+cond) | PM <sub>10</sub><br>TOTAL<br>(filt+cond) | PM <sub>2.5</sub><br>TOTAL<br>(filt+cond) | CO        |
|   | tons/year       | tons/year       | tons/year | tons/year                  | tons/year                                | tons/year                                 | tons/year |
| Pre-Push Emissions                        | 0.176           | 0.623           | 0.113     | 11.949                     | 6.174                                    | 5.775                                     | 0.140     |
| WITHOUT HOOD                              |                 |                 |           |                            |  |   |           |
| Pushing Fugitives                         | 0.2             | 1.3             | 1.0       | 5.9                        | 3.2                                      | 2.0                                       | 0.8       |
| WITH HOOD                                 |                 |                 |           |                            |  |   |           |
| PEC BH                                    | 13.5            | 50.5            | 3.1       | 15.2                       | 7.2                                      | 3.5                                       | 33.9      |
| Traveling                                 | 10.9            | 40.6            |           | 23.2                       | 8.7                                      | 3.2                                       | 8.7       |
| PEC fugitives                             | 1.7             | 6.4             | 29.8      | 172.0                      | 95.3                                     | 59.1                                      | 23.0      |
| Quenching                                 |                 | 10.4            | 35.5      | 367.1                      | 297.0                                    | 226.9                                     |           |
| STACK TOTAL (from Stacks 2006)            | 1035.0          | 102.4           | 6.7       | 95.8                       | 91.2                                     | 89.5                                      | 418.0     |
| Batt Mill                                 | 0.6             | 60.9            | 3.7       | 0.015                      | 0.015                                    | 0.015                                     |           |
| Soaking                                   |                 |                 |           | 9.2                        |  |   | 715.6     |
| Decarbonization                           |                 |                 |           |                            |  |   |           |
| Fugitives                                 |                 |                 |           |                            |  |   |           |
| Doors                                     |                 |                 | 6.8       | 5.5                        |  |   | 3.4       |
| Lids                                      |                 |                 | 0.0       | 0.01                       |  |   | 0.01      |
| Charging                                  |                 |                 | 0.4       | 0.4                        |  |   | 0.2       |
| Offtakes                                  |                 |                 | 0.2       | 0.2                        |  |   | 0.1       |
| TOTAL                                     | 1062.2          | 273.0           | 87.3      | 706.4                      | 508.9                                    | 390.0                                     | 1203.8    |

Table 2-2 Future Allowable Emissions for C Battery, Quenching

| Future Allowable Emissions for BATTERY C |                 |                 |           |                            |  |   |           |
|--|-----------------|-----------------|-----------|----------------------------|--|---|-----------|
| PROCESS                                  | NO <sub>x</sub> | SO <sub>2</sub> | VOC       | PM<br>TOTAL<br>(filt+cond) | PM <sub>10</sub><br>TOTAL<br>(filt+cond) | PM <sub>2.5</sub><br>TOTAL<br>(filt+cond) | CO        |
|  | tons/year       | tons/year       | tons/year | tons/year                  | tons/year                                | tons/year                                 | tons/year |
| Pre-Push Emissions                       | 0.006           | 0.023           | 0.001     | 12.869                     | 6.649                                    | 6.220                                     | 0.004     |
| WITHOUT HOOD                             |                 |                 |           |                            |  |   |           |
| Pushing Fugitives                        | 0.2             | 0.8             | 0.6       | 3.6                        | 2.0                                      | 1.2                                       | 0.5       |
| WITH HOOD                                |                 |                 |           |                            |  |   |           |
| PEC BH                                   | 15.9            | 59.5            | 1.2       | 33.5                       | 14.9                                     | 6.1                                       | 38.2      |
| Traveling                                | 6.4             | 24.1            |           | 13.8                       | 5.2                                      | 1.9                                       | 5.2       |
| PEC fugitives                            | 0.9             | 3.5             | 20.4      | 119.1                      | 65.8                                     | 40.7                                      | 16.2      |
| Quenching                                |                 | 12.8            | 43.9      | 108.3                      | 105.5                                    | 102.8                                     |           |
| STACK TOTAL (from Stacks_2006)           | 461.2           | 91.9            | 5.0       | 17.3                       | 16.8                                     | 16.6                                      | 351.7     |
| Ball Mill                                |                 |                 |           | 0.017                      | 0.017                                    | 0.017                                     |           |
| Soaking                                  | 0.3             | 34.1            | 2.1       | 5.2                        |  |   |           |
| Decarbonization                          |                 |                 |           |                            |  |   | 691.8     |
| Fugitives                                |                 |                 |           |                            |  |   |           |
| Doors                                    |                 |                 | 2.6       | 2.2                        |  |   | 1.3       |
| Lids                                     |                 |                 | 0.1       | 0.1                        |  |   | 0.04      |
| Charging                                 |                 |                 | 0.5       | 0.4                        |  |   | 0.2       |
| Offtakes                                 |                 |                 | 0.1       | 0.1                        |  |   | 0.1       |
| TOTAL                                    | 485.0           | 226.7           | 76.5      | 316.5                      | 216.9                                    | 175.6                                     | 1105.2    |

### 3.0 Applicable Regulations

This section discusses local, state and federal air quality regulations applicable to the proposed C Battery replacement project. The following air regulations have been reviewed for applicability to the Project.

| Regulatory Program                                     | Citation                | Applicable | Non-Applicable | Comments  |
|--|-------------------------|------------|----------------|---|
| Installation Permit                                    | §2102.04                | X          |                | Required before commencing construction   |
| Installation Permit for New and Modified Major Sources | §2102.05                |            | X              | Not applicable because net emissions change < 0.0 tons per year                     |
| New Source Review - Nonattainment Area                 | §2102.06                |            | X              | Netting out of Nonattainment Review   |
| New Source Review - PSD Program                        | §2102.07                |            | X              | Netting out of PSD Review   |
| Title V Operating Permit                               | §2103.14                | X          |                | Modify existing draft Title V permit  |
| Allegheny County Emission Standards                    | §2104                   | X          |                | Standards for coke screening, coal pulverizers                                      |
| Allegheny County Source Operating Standards            | §2105                   | X          |                | Standards for charging, doors, offtakes, pushing, combustion stacks, quenching, COG |
| NESHAPS  | 40 CFR 63 Subpart L     | X          |                | Leaks from Coke Ovens   |
| NESHAPS  | 40 CFR 63 Subpart CCCCC | X          |                | Pushing, Quenching, Battery Stack   |

### **3.1 Allegheny County Health Department Rules and Regulations, Article XXI Air Pollution Control**

This Installation Permit Application document has been prepared in order to address all the requirements outlined in Article XXI of the ACHD regulations.

#### **§2102.04 Installation Permits**

This Section requires United States Steel to obtain an Installation Permit (Permit) to install the proposed C Battery project. This section also describes the standards for issuance of the Permit and what must be included in the application. These include:

- Identification of other Permits issued by the Department (see Appendix G)
- Nature and amount of emissions from the sources affected
- Location, design, construction and operation of the sources affected and from associated mobile sources;
- Compliance with NAAQS in attainment areas and no interference with achievement of reasonable further progress in non attainment areas (modeling to be submitted separately)
- Compliance with all applicable emissions limits established by this Article
- Application of Best Available Control Technology (BACT) for new sources;
- Compliance with applicable NSPS, MACT and NESHAPS standards;
- Compliance with all applicable requirements of the Air Pollution Control Act by all existing air pollution sources within the Commonwealth which are required to have operating permits;
- A plan to prevent fugitive dust from becoming airborne during construction (See Appendix F)

#### **§2102.05 Installation Permits for New and Modified Major Source**

This Section applies to the Project if the Project increases the amount of any air contaminant emitted by the source or if the Project results in the emission of any air contaminant not previously emitted.

Requirements of this Section include:

- Interstate notification
- Public hearing and notice

#### **§2102.06 Major Sources Locating in or Impacting a Nonattainment Area**

This section applies to any major new sources and to any major modification of an existing source which is located in a nonattainment area or transport region of the County or which will have a significant impact on any nonattainment area or transport region.

The Clairton Plant is located in a PM<sub>2.5</sub> nonattainment area and within the Northeast Ozone Transport Region (NOTR). However, this Section of the regulations does not apply to the Project because the Project will not be a major modification, that is, it will produce emission increases that are less than the emission rate thresholds specified in 25 Pa. Code §127.203 for PM<sub>10</sub> (used as a surrogate for PM<sub>2.5</sub>)<sup>1</sup> and less than the proposed emission rate thresholds for direct PM<sub>2.5</sub> emissions and significance levels for PM<sub>2.5</sub> precursors SO<sub>2</sub> and NO<sub>x</sub> (Federal Register /Vol. 70, No. 210/ Nov. 1, 2005 /Proposed Rules, pp. 66034

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<sup>1</sup> While EPA finalized certain provisions of the PM<sub>2.5</sub> implemented rule on April 5, 2007, EPA has not finalized the PM<sub>2.5</sub> implemented rule for NSR.

[http://www.epa.gov/pmdesignations/documents/Sep05/PM25\\_proposed\\_impl\\_rule.pdf](http://www.epa.gov/pmdesignations/documents/Sep05/PM25_proposed_impl_rule.pdf)). The Project will also produce less than significant increases for NO<sub>x</sub> and VOC which are precursors to ozone formation. The significance levels that trigger review under §2102.06 are listed in 25 Pa. Code §121.1 and are:

#### **Nonattainment Review Thresholds for PM<sub>2.5</sub>**

- PM<sub>10</sub> (surrogate for PM<sub>2.5</sub>) 15 TPY (April 5, 2005 EPA memo from Stephen Page)
- Direct PM<sub>2.5</sub> (proposed) 10 TPY (Federal Register /Vol. 70)
- Precursor emissions of SO<sub>2</sub>, NO<sub>x</sub> 40 TPY SO<sub>2</sub>, 40 TPY NO<sub>x</sub> (Federal Register /Vol. 70)

#### **Nonattainment Review Thresholds for Ozone in NOTR**

- NO<sub>x</sub> 40 TPY (25 Pa. Code §121.1)
- VOC 40 TPY (25 Pa. Code §121.1)

Section 3.2 presents a demonstration that nonattainment New Source Review does not apply to the Project.

At the request of the ACHD, U. S. Steel Corporation will submit a PM<sub>2.5</sub> dispersion modeling analysis sometime in February, 2008.

#### **§2102.07 Prevention of Significant Deterioration**

This Section adopts the PSD requirements in 40 CFR §52.21. Section 3.2 below presents a demonstration that PSD review does not apply to the Project.

### **Part C – Operating Permits**

§2103.14 allows a company to apply for an administrative Amendment to its current Title V Operating Permit to incorporate the requirements from Installation Permits. U.S. Steel Clairton Plant does not have a Title V permit. The ACHD has issued a draft Title V permit for comment. It may be possible to modify this draft before the final permit is issued.

### **Part D – Pollutant Emission Standards**

#### **§2104.01 Visible Emissions**

This Section limits opacity from any source to an aggregate of 20% within any 3-minute period and a maximum of 60% (instantaneous) never to be exceeded. This Section does not apply to the C Battery but would apply to coal and coke handling and to the C Battery quench tower.

#### **§2104.02 Particulate Mass Emissions**

This Section contains limits for particulate matter from the No. 1 and No. 2 coal pulverizers at Clairton Plant. Limits are in grains per ton of coal. This Project will not affect these limits.

This Section also requires an emission control device on No. 3 Coke Screening Station and limits particulate to 2.8 grains/ton of coke at any time. This emission limit is in error and is being revised by ACHD to 0.0065 gr/dscf. Coke produced by C Battery will use a new screening station.

#### **§2104.04 Odor Emissions**

This Section prohibits off property odors.

#### **§2104.05 Materials Handling**

This Section prohibits visible off property emissions generated by material handling.

#### **§2104.07 Stack Heights**

This Section incorporates the Federal stack height regulations and prohibits taking dispersion credit for stacks taller than Good Engineering Practice (GEP) height.

#### **§2104.08 National Emission Standards for Hazardous Air Pollutants**

This Section incorporates the Federal regulations. See **Section 3.3** below for specific NESHAP applicability to the C Battery Project.

#### **§2105.21 Coke Ovens and Coke Oven Gas.**

This Section regulates existing coke oven operations at the Clairton Plant, including visible emissions from charging, visible emissions from doors, charging ports and offtake piping. Pushing operations must have a control device that meets Best Available Control Technology (BACT). Mass emission limits and opacity limits are established for the control device. Particulate emission limits are set for the C Battery Combustion stacks. Quenching must use clean water and the coke quenching emissions must be vented through a baffled quench tower. Unburned coke oven gas must not be vented into the open air unless the hydrogen sulfide content of the gas meets a specified limit. Testing requirements are listed.

#### **Enforcement Orders and Consent Decrees and Agreements**

***Section 202.E. Order Requiring Monthly Reports to Determine Compliance with Sections 520 and 530 of Article XX at U.S. Steel Clairton Works, March 28, 1990.***

Requires reporting of monthly coke plant operation to the ACHD.



***Enforcement Order No. 200 Upon Consent, November 18, 1999.***

United States Steel Clairton Plant shall operate and maintain two Claus Plants, the HCN Destruct Unit, Vacuum Carbonate Unit, Heat Exchangers and Pumps, and report the breakdown or unavailability of these pieces of equipment.

***Second Consent Order and Agreement***

This Order requires quenching emissions to be vented through a baffled quench tower (page 15 in paragraph V.G. of the Order). Required reporting of quenching in violation of paragraph V.G. is referenced on page 38 in paragraph XIII.A.5.

**3.2 Prevention of Significant Deterioration and Non-attainment New Source Review Applicability Analysis**

This Section presents an analysis demonstrating NSR non-applicability for the proposed C Battery replacement project only. Project design for the D Battery project has not advanced to the point where a non-applicability analysis can be performed. United States Steel recognizes the possibility that splitting the non-applicability analysis could be interpreted as segmentation in order to avoid triggering NSR. Each project separately or as an aggregate will provide a net emission decrease and not trigger NSR.

**3.2.1 Regulatory Background**

Allegheny County is designated as attaining the National Ambient Air Quality Standards (NAAQS) for SO<sub>2</sub>, PM<sub>10</sub>, CO and NO<sub>2</sub> and non-attaining for PM<sub>2.5</sub> and ozone. The pollutant SO<sub>2</sub> is considered a precursor of PM<sub>2.5</sub> and is likely to be treated as a non-attaining pollutant under forthcoming PM<sub>2.5</sub> regulations. Similarly VOC is a precursor for ozone. NO<sub>x</sub> is considered a precursor for both PM<sub>2.5</sub> and ozone. Both VOC and NO<sub>x</sub> are likely to be treated as non-attainment pollutants for purposes of major new source review.

The Prevention of Significant Deterioration (PSD) regulations apply to new major sources and major modifications located in areas that are attaining the NAAQS. As a coke battery, the Clairton Plant is one of the twenty-eight major source categories listed in the PSD regulations (40 CFR 52.21). Existing potential emissions from this facility exceed 100 tons per year for at least one pollutant. Therefore, the coke plant is a major source. For the C Battery Project to be a major modification, that is, for it to undergo PSD review, the net change in emissions due to the Project plus other contemporaneous increases and decreases in actual emissions would have to exceed PSD significance levels for at least one pollutant. U.S. Steel expects that there will be a net decrease in facility-wide emissions due to the project for attaining pollutants (SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub> and CO).

Final rules for implementing the PM<sub>2.5</sub> regulations for New Source Review in nonattainment areas (NNSR) have not been promulgated. Interim policy is to use PM<sub>10</sub> as a surrogate for PM<sub>2.5</sub>. ENSR expects that the final PM<sub>2.5</sub> NNSR rules will be issued in January 2008 and that they will contain procedures for calculating net changes in direct PM<sub>2.5</sub> emissions and for precursor emissions (SO<sub>2</sub> and NO<sub>x</sub>). Therefore, we will calculate net changes in these emissions as well.

In this project, NNSR Nonapplicability analysis for PM<sub>2.5</sub> will be done in two ways: Alternative 1 will assume that PM<sub>10</sub> is the surrogate for PM<sub>2.5</sub> and Alternative 2 will assume that the plant's direct emissions of PM<sub>2.5</sub> and its precursors NO<sub>x</sub> and SO<sub>2</sub> are accounted for in determining NNSR applicability.

### 3.2.2 Overview of Emissions Netting Procedures

In assessing PSD and NNSR applicability, ENSR will use the following procedures described in PADEP's Pennsylvania Code, Subchapter E, § 127.203a.:

1. Calculate the future allowable emissions for the new units; if the future emissions from the new units exceed PSD and/or NNSR significance levels (we expect they will), then
2. Calculate baseline actual emissions for existing units affected by the C Battery Project, that is, existing units that will be shut down and units whose emissions will increase or decrease, and
3. Calculate contemporaneous emission changes associated with minor source permits;
4. Subtract emissions calculated in steps 2. and 3. from those in step 1. to determine the net emissions change resulting from the Project. If the difference is less than the PSD and NNSR significance limits, the project is considered a minor modification and PSD and NNSR will not apply.

#### 3.2.2.1 Calculating Future Allowable Emissions from New Equipment

The Project will involve a complete replacement of Batteries 7, 8, and 9 by C Battery. The following new emission sources will be installed:

- Coke Oven "C" Battery:
  - Coal charging
  - Coking
    - Doors
    - lids,
    - offtakes,
    - decarbonization,
  - soaking
  - pushing (PEC Baghouse, PEC fugitives, uncontrolled pushing)
  - travel to the quench tower and,
  - combustion stack
- C Battery Quench Tower

Some of the future allowable emissions have been provided by Uhde Corporation, the design and construction firm on this project. However, Uhde Corporation was not able to provide guaranteed emission rates for all segments of the process. Therefore, for some segments, U.S. Steel is using its engineering judgment.

#### 3.2.2.2 Calculating Baseline Actual Emissions

U.S. Steel will calculate baseline actual emissions for affected units. These include:

- Coal handling (there will be an increase in coal handling due to the Project)
- Batteries 7-9 (to be shut down)
- #3 Quench Tower serving Batteries 7-9 (to be shut down)
- # 1 and new coke screening station (there will be less use of # 1 Screening Station and greater use of a new Screening Station and new air pollution control equipment will be installed on the new Screening Station).

Allegheny County Health Department's (ACHD) air pollution regulations are codified in Article XXI Air Pollution Control. These regulations do not include guidance on calculating baseline actual emissions. Therefore, we are using Pennsylvania Department of Environmental Protection (PADEP) guidance contained in Pennsylvania Code, Subchapter E New Source Review, § 127.203a. Applicability (a) (4) (i) which states that

"for an existing emissions unit, baseline actual emissions are the average rate, in TPY, at which the unit emitted the regulated NSR pollutant during a consecutive 24-month period selected by the owner or operator within the 5-year period immediately prior to the date a complete plan approval application is received by the Department. The Department may approve the use of a different consecutive 24-month period within the last 10 years upon a written determination that it is more representative of normal source operation."

"The average rate includes fugitive emissions to the extent quantifiable and emissions associated with startups and shutdowns; the average rate does not include excess emissions including emissions associated with upsets and malfunctions"

"The average rate is adjusted downward to exclude non compliant emissions...."

"The average rate is adjusted downward to exclude emissions that would have exceeded an emissions limitation with which the facility must currently comply..."

"For a regulated NSR pollutant, when a project involves multiple emissions units, the same consecutive 24-month period must be used to determine the baseline actual emissions for the units being changed."

U.S. Steel plans to submit the installation permit application on January 2, 2008. U.S. Steel assumes that ACHD will deem the application complete on or before February 2, 2008. Therefore, the 5-year look back period would begin February 2, 2003 and end February 1, 2008. USS is requesting to use a 24-month period beginning May 1, 2002 and ending April 30, 2004. A total of nine months in this period is prior to the 5-year look back period that begins February 2, 2003. U.S. Steel is requesting a different 24-month period because:

- Coal deliveries were interrupted from December 2003 through February, 2004 and again from December 2004 through February 2005, causing a shortage of coal on site, thus limiting the amount of coal that could be charged to the batteries. Batteries 1 - 3 and 7 - 9 were particularly affected.
- Batteries 7 - 9 are now taking 20-22 hours to produce higher stability coke rather than the design 18 hour period. The longer coking times are required in order to meet customer requirements. C Battery would be able to produce the same higher quality coke in 18 hours. The longer overall coking times in 1 - 3 Batteries result in lower coke production than desired.
- The number of ovens available for coke production has been decreasing due to oven conditions and increased oven refractory maintenance.

### **3.2.2.3 Contemporaneous Emission Changes**

Again, the ACHD regulations do not define contemporaneous emission changes. The PADEP regulations [§ 127.203a.(a)(ii)(B)(l)] define contemporaneous emissions changes as follows:

"An increase or decrease in actual emissions is contemporaneous with the increase from the particular change only if it occurs between the date 5 years before construction on the project commences and the date that construction on the project is completed. Construction is planned to start July 1, 2008 and end by June 1, 2011. Therefore, the contemporaneous period for this project begins June 1, 2003 and will end June 1, 2011."

### **3.2.3 Future Allowable Emissions from New Equipment**

New equipment associated with the proposed C Battery project will consist of the proposed C Battery and the C Battery quench tower. A new screening station to be permitted separately. Descriptions of the new equipment and equipment modifications are presented in **Section 2.2**

Future allowable emissions are presented in **Table 3-1** for the proposed C Battery including the new quench tower.

### **3.2.4 Baseline Actual Emissions**

Baseline actual emissions were calculated for the period May 1, 2002 through April 30, 2004 as mentioned in **Section 1.2.2**. Baseline actual emissions were calculated for the following affected processes: coal handling, Batteries 7-9, Batteries 7-9 quench tower and # 1 and new coke screening stations.

**Table 3-2** presents baseline actual emissions for Batteries 7 - 9 and quenching.

### **3.2.5 Contemporaneous Emission Changes**

The only emission change during the contemporaneous period will be those associated with increased coal handling due to C Battery and emission changes associated with coke handling operations. **Table 3-3** presents contemporaneous emission changes for coal and coke handling. Coal handling at the Clairton Plant associated with other processes that are not affected by the Project (e.g., coal charged in Batteries 7 – 9) are not included in **Table 3-3**.

Coal handling emissions will be affected by the Project because additional coal will be offloaded from the barges, pulverized, sent to a surge bin, conveyed to C Battery and charged in C Battery. Less coke will be processed in # 1 screening station because that station will not be used by C Battery. More coke will be processed in a new screening station to be used by B, C, and D Batteries.

Table 3-1 Future Allowable Emissions from C Battery, Quench Tower

| Future Allowable Emissions for BATTERY C |                 |                 |           |                            |  |   |           |
|--|-----------------|-----------------|-----------|----------------------------|--|---|-----------|
| PROCESS                                  | NO <sub>x</sub> | SO <sub>2</sub> | VOC       | PM<br>TOTAL<br>(filt+cond) | PM <sub>10</sub><br>TOTAL<br>(filt+cond) | PM <sub>2.5</sub><br>TOTAL<br>(filt+cond) | CO        |
|  | tons/year       | tons/year       | tons/year | tons/year                  | tons/year                                | tons/year                                 | tons/year |
| Pre-Push Emissions                       | 0.006           | 0.023           | 0.001     | 12.869                     | 6.649                                    | 6.220                                     | 0.004     |
| WITHOUT HOOD                             | 0.2             | 0.8             | 0.6       | 3.6                        | 2.0                                      | 1.2                                       | 0.5       |
| Pushing Fugitives                        |                 |                 |           |                            |  |   |           |
| WITH HOOD                                | 15.9            | 59.5            | 1.2       | 33.5                       | 14.9                                     | 6.1                                       | 38.2      |
| PEC BH                                   | 6.4             | 24.1            |           | 13.8                       | 5.2                                      | 1.9                                       | 5.2       |
| Traveling                                | 0.9             | 3.5             | 20.4      | 119.1                      | 65.8                                     | 40.7                                      | 16.2      |
| PEC fugitives                            |                 |                 |           |                            |  |   |           |
| Quenching                                |                 | 12.8            | 43.9      | 108.3                      | 105.5                                    | 102.8                                     |           |
| STACK TOTAL (from Stacks_2006)           | 461.2           | 91.9            | 5.0       | 17.3                       | 16.8                                     | 16.6                                      | 351.7     |
| Ball Mill                                |                 |                 |           | 0.017                      | 0.017                                    | 0.017                                     |           |
| Soaking                                  | 0.3             | 34.1            | 2.1       | 5.2                        |  |   |           |
| Decarbonization                          |                 |                 |           |                            |  |   | 691.8     |
| Fugitives                                |                 |                 |           |                            |  |   |           |
| Doors                                    |                 |                 | 2.6       | 2.2                        |  |   | 1.3       |
| Lids                                     |                 |                 | 0.1       | 0.1                        |  |   | 0.04      |
| Charging                                 |                 |                 | 0.5       | 0.4                        |  |   | 0.2       |
| Offtakes                                 |                 |                 | 0.1       | 0.1                        |  |   | 0.1       |
| TOTAL                                    | 485.0           | 226.7           | 76.5      | 316.5                      | 216.9                                    | 175.6                                     | 1105.2    |

Table 3-2 Baseline Actual Emissions from Batteries 7-9

| Actual Annual Emissions for BATTERIES 7-9 |                 |                 |           |                                |                                |                                |           |
|---|-----------------|-----------------|-----------|--------------------------------|--------------------------------|--------------------------------|-----------|
| PROCESS                                   | NO <sub>x</sub> | SO <sub>2</sub> | VOC       | PM                             | PM <sub>10</sub>               | PM <sub>2.5</sub>              | CO        |
|   | tons/year       | tons/year       | tons/year | TOTAL (filt+cond)<br>tons/year | TOTAL (filt+cond)<br>tons/year | TOTAL (filt+cond)<br>tons/year | tons/year |
| Pre-Push Emissions                        | 0.176           | 0.623           | 0.113     | 11.949                         | 6.174                          | 5.775                          | 0.140     |
| WITHOUT HOOD                              |                 |                 |           |                                |                                |                                |           |
| Pushing Fugitives                         | 0.2             | 1.3             | 1.0       | 5.9                            | 3.2                            | 2.0                            | 0.8       |
| WITH HOOD                                 |                 |                 |           |                                |                                |                                |           |
| PEC BH                                    | 13.5            | 50.5            | 3.1       | 15.2                           | 7.2                            | 3.5                            | 33.9      |
| Traveling                                 | 10.9            | 40.6            |           | 23.2                           | 8.7                            | 3.2                            | 8.7       |
| PEC fugitives                             | 1.7             | 6.4             | 29.8      | 172.0                          | 95.3                           | 59.1                           | 23.0      |
| Quenching                                 |                 | 10.4            | 35.5      | 367.1                          | 297.0                          | 226.9                          |           |
| STACK TOTAL (from Stacks 2006)            | 1035.0          | 102.4           | 6.7       | 95.8                           | 91.2                           | 89.5                           | 418.0     |
| Ball Mill                                 |                 |                 |           |                                |                                |                                |           |
| Soaking                                   | 0.6             | 60.9            | 3.7       | 0.015                          | 0.015                          | 0.015                          |           |
| Decarbonization                           |                 |                 |           |                                |                                |                                | 715.6     |
| Fugitives                                 |                 |                 |           |                                |                                |                                |           |
| Dodrs                                     |                 |                 | 6.8       | 5.5                            |                                |                                | 3.4       |
| Lids                                      |                 |                 | 0.0       | 0.01                           |                                |                                | 0.01      |
| Charging                                  |                 |                 | 0.4       | 0.4                            |                                |                                | 0.2       |
| Offtakes                                  |                 |                 | 0.2       | 0.2                            |                                |                                | 0.1       |
| TOTAL                                     | 1062.2          | 273.0           | 87.3      | 706.4                          | 508.9                          | 390.0                          | 1203.8    |

Table 3-3 Contemporaneous Emission Changes from Coal Handling

| COAL HANDLING                   | Pulverizer |          |          |          | Unloader  |          |           | Pedestal Crane | Coal Transfer | Boom Conveyor | Bins and Bunkers | Storage Piles acre*day | Emission TPY |
|---------------------------------|------------|----------|----------|----------|-----------|----------|-----------|----------------|---------------|---------------|------------------|------------------------|--------------|
|                                 | #1 Pri     | #1 Sec   | #2 Pri   | #2 Sec   | #1        | #2       | Clamshell |                |               |               |                  |                        |              |
| Batteries 7-9 (tons per period) | 1,229,551  | -        | -        | -        | 1,168,073 | -        | 184,433   | 61,478         | 1,229,551     | 110,660       | 1,229,551        | 12,296                 |              |
| Emission Factors (lb/ton coal)  |            |          |          |          |           |          |           |                |               |               |                  |                        |              |
| PM <sub>2.5</sub>               | 1.44E-04   | 2.52E-04 | 2.04E-05 | 3.40E-05 | 1.17E-04  | 1.16E-04 | 1.16E-04  | 1.16E-04       | 1.65E-04      | 1.17E-04      | 4.00E-06         | 2.08E+00               |              |
| PM <sub>10</sub>                | 5.77E-04   | 1.01E-03 | 8.17E-05 | 1.36E-04 | 3.64E-04  | 3.60E-04 | 3.60E-04  | 3.60E-04       | 5.20E-04      | 3.64E-04      | 4.00E-06         | 2.08E+00               |              |
| TSP                             | 2.88E-03   | 5.04E-03 | 4.08E-04 | 6.80E-04 | 7.77E-04  | 7.76E-04 | 7.76E-04  | 7.76E-04       | 1.10E-03      | 7.77E-04      | 6.24E-06         | 4.62E+00               |              |
| Emissions (tons)                |            |          |          |          |           |          |           |                |               |               |                  |                        |              |
| PM <sub>2.5</sub>               | 0.09       | -        | -        | -        | 0.07      | -        | 0.01      | 0.00           | 0.10          | 0.01          | 0.00             | 12.79                  | 13.1         |
| PM <sub>10</sub>                | 0.35       | -        | -        | -        | 0.21      | -        | 0.03      | 0.01           | 0.32          | 0.02          | 0.00             | 12.79                  | 13.7         |
| TSP                             | 1.77       | -        | -        | -        | 0.45      | -        | 0.07      | 0.02           | 0.68          | 0.04          | 0.00             | 28.40                  | 31.4         |
| Battery C (tons per year)       | 1,379,059  | -        | -        | -        | 1,310,106 | -        | 275,812   | 137,906        | 1,379,059     | 165,487       | 1,379,059        | 13,791                 |              |
| Emission Factors (lb/ton coal)  |            |          |          |          |           |          |           |                |               |               |                  |                        |              |
| PM <sub>2.5</sub>               | 1.44E-04   | 2.52E-04 | 2.04E-05 | 3.40E-05 | 1.17E-04  | 1.16E-04 | 1.16E-04  | 1.16E-04       | 1.65E-04      | 1.17E-04      | 4.00E-06         | 2.08E+00               |              |
| PM <sub>10</sub>                | 5.77E-04   | 1.01E-03 | 8.17E-05 | 1.36E-04 | 3.64E-04  | 3.60E-04 | 3.60E-04  | 3.60E-04       | 5.20E-04      | 3.64E-04      | 4.00E-06         | 2.08E+00               |              |
| TSP                             | 2.88E-03   | 5.04E-03 | 4.08E-04 | 6.80E-04 | 7.77E-04  | 7.76E-04 | 7.76E-04  | 7.76E-04       | 1.10E-03      | 7.77E-04      | 6.24E-06         | 4.62E+00               |              |
| Emissions (tons)                |            |          |          |          |           |          |           |                |               |               |                  |                        |              |
| PM <sub>2.5</sub>               | 0.10       | -        | -        | -        | 0.08      | -        | 0.02      | 0.01           | 0.11          | 0.01          | 0.00             | 14.34                  | 14.7         |
| PM <sub>10</sub>                | 0.40       | -        | -        | -        | 0.24      | -        | 0.05      | 0.02           | 0.36          | 0.03          | 0.00             | 14.34                  | 15.4         |
| TSP                             | 1.99       | -        | -        | -        | 0.51      | -        | 0.11      | 0.05           | 0.76          | 0.06          | 0.00             | 31.86                  | 35.3         |

Note: Emission factors for storage piles are in lb/(acre\*day)

Note: Emission factors for storage piles are in lb/(acre\*day)

|                   | Batteries 7-9 (TPY) | Battery C (TPY) | Reduction (TPY) |
|-------------------|---------------------|-----------------|-----------------|
| PM <sub>2.5</sub> | 13,069              | 14,668          | -1,600          |
| PM <sub>10</sub>  | 13,741              | 15,444          | -1,703          |
| TSP               | 31,448              | 35,341          | -3,894          |

Table 3-4 Contemporaneous Emission Changes from Coke Handling

| COKE HANDLING   |          | Coke Pile (Load & unload) | Coke Transfer | Screen Stn. | Screening Stn. Loadout | Coke Pile Erosion | TOTAL |
|---|----------|---------------------------|---------------|-------------|------------------------|-------------------|-------|
| Batteries 7-9 (tons per period)                               |          | 2,062                     | 896,421       | 896,421     | 896,421                | 8,785             | TPY   |
| Emission Factors (lb/ton coke)                                |          |                           |               |             |                        |                   |       |
| PM <sub>2.5</sub>   | 7.10E-03 |                           | 7.10E-03      | 2.65E-04    | 2.00E-04               | 5.20E-01          |       |
| PM <sub>10</sub>  | 7.10E-03 |                           | 7.10E-03      | 8.40E-04    | 7.00E-04               | 5.20E-01          |       |
| TSP   | 1.50E-02 |                           | 1.50E-02      | 1.76E-03    | 1.00E-03               | 1.16E+00          |       |
| Emissions (tons)  |          |                           |               |             |                        |                   |       |
| PM <sub>2.5</sub>   | 0.01     |                           | 3.18          | 0.12        | 0.09                   | 2.28              | 5.7   |
| PM <sub>10</sub>  | 0.01     |                           | 3.18          | 0.38        | 0.31                   | 2.28              | 6.2   |
| TSP   | 0.02     |                           | 6.72          | 0.79        | 0.45                   | 5.10              | 13.1  |
| Battery C (tons)  |          | 2,547                     | 1,107,384     | 1,107,384   | 1,107,384              | 10,852            |       |
| Emission Factors (lb/ton coke)                                |          |                           |               |             |                        |                   |       |
| PM <sub>2.5</sub>   | 7.10E-03 |                           | 7.10E-03      | 2.65E-04    | 2.00E-04               | 5.20E-01          |       |
| PM <sub>10</sub>  | 7.10E-03 |                           | 7.10E-03      | 8.40E-04    | 7.00E-04               | 5.20E-01          |       |
| TSP   | 1.50E-02 |                           | 1.50E-02      | 1.76E-03    | 1.00E-03               | 1.16E+00          |       |
| Emissions (tons)  |          |                           |               |             |                        |                   |       |
| PM <sub>2.5</sub>   | 0.01     |                           | 3.93          | 0.15        | 0.11                   | 2.82              | 7.0   |
| PM <sub>10</sub>  | 0.01     |                           | 3.93          | 0.47        | 0.39                   | 2.82              | 7.6   |
| TSP   | 0.02     |                           | 8.31          | 0.98        | 0.55                   | 6.29              | 16.1  |
| Note: Emission factors for storage piles are in lb/(acre*day) |          |                           |               |             |                        |                   |       |

|                   | Batteries 7-9 (TPY) | Battery C (TPY) | Reduction (TPY) |
|-------------------|---------------------|-----------------|-----------------|
| PM <sub>2.5</sub> | 5.68                | 7.02            | -1.34           |
| PM <sub>10</sub>  | 6.16                | 7.61            | -1.45           |
| TSP               | 13.07               | 16.15           | -3.08           |



Table 3-5 Results of Emissions Netting Analysis

| APPLICABILITY ANALYSIS |                                     |                         |                         |   |                           |                           |                           |                           |                    |                              |                       |
|------------------------|-------------------------------------|-------------------------|-------------------------|---|---------------------------|---------------------------|---------------------------|---------------------------|--------------------|------------------------------|-----------------------|
| Pollutant              | Emission Increases due to C Battery |                         |                         | Emission Decreases due to Retirement of 7-9 Batteries |                           |                           | Net Emission Change (TPY) | PSD Significant Threshold | PSD Applicability? | NA NSR Significant Threshold | NA NSR Applicability? |
|                        | Installation of Battery C           | Coal Handling Battery C | Coke Handling Battery C | Retirement of Batteries 7-9                           | Coal handling Battery 7-9 | Coke handling Battery 7-9 |                           |                           |                    |                              |                       |
| NO <sub>x</sub>        | 485.0                               |                         |                         | 1062.2  |                           |                           | -577.2                    | 25                        | NO                 | 40                           | NO                    |
| SO <sub>2</sub>        | 226.7                               |                         |                         | 273.0   |                           |                           | -46.4                     | 40                        | NO                 | N/A                          | N/A                   |
| VOC                    | 76.5                                |                         |                         | 87.3  |                           |                           | -10.7                     | N/A                       | N/A                | 40                           | NO                    |
| TSP                    | 316.5                               | 35.3                    | 16.1                    | 706.4   | 31.4                      | 13.1                      | -382.9                    | N/A                       | N/A                | 25                           | NO                    |
| PM <sub>10</sub>       | 216.9                               | 15.4                    | 7.6                     | 508.9   | 13.7                      | 6.2                       | -288.8                    | 15                        | NO                 | N/A                          | N/A                   |
| PM <sub>2.5</sub>      | 175.6                               | 14.7                    | 7.0                     | 390.0   | 13.1                      | 5.7                       | -211.4                    | N/A                       | N/A                | 10                           | NO                    |
| CO                     | 1105.2                              |                         |                         | 1203.8  |                           |                           | -98.7                     | 100                       | NO                 | N/A                          | N/A                   |
| Lead                   | 0.012                               |                         |                         | 0.012   |                           |                           | 0.000                     | 0.6                       | NO                 | N/A                          | N/A                   |
| H <sub>2</sub> S       | 148.291                             |                         |                         | 277.289   |                           |                           | -129.0                    | 10                        | NO                 | N/A                          | N/A                   |
| TRS                    | 151.945                             |                         |                         | 300.767   |                           |                           | -148.8                    | 10                        | NO                 | N/A                          | N/A                   |

N/A = Not Applicable

NO<sub>x</sub>, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

N/A = Not Applicable

NO<sub>x</sub>, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

### 3.2.6 Results of Emissions Netting Analysis

**Table 3-5** presents a summary of the emissions netting analysis. The table indicates that the C Battery Project will produce a net reduction in emissions of all PSD and Nonattainment New Source Review pollutants. The Project will thus net out of PSD and Nonattainment New Source review.

On a pollutant-by-pollutant basis, a large decrease will occur for Total Particulate matter (PM = TSP) and PM<sub>10</sub>. Annual PM emissions will be reduced by 382.9 tons per year (TPY). Most of the PM reductions will be associated with better capture of PEC fugitives and more efficient PM capture in the quench tower. Associated PM<sub>10</sub> emission reductions will be on the order of 288.8 TPY. CO emissions will be reduced by 98.7 TPY. The CO reduction will be achieved through an approximate 10% reduction in COG burned in the underfire stack and reductions from decarbonization associated with the PROven® system.

NO<sub>x</sub> emissions will decrease by 577.2 TPY and SO<sub>2</sub> emissions will decrease by 46.4 TPY. The NO<sub>x</sub> decreases are mostly due to lower amounts of COG burned at the facility and use of a low NO<sub>x</sub> combustion system in C Battery. The SO<sub>2</sub> decreases are due to lower COG combustion, lower travel emissions due to shorter travel distances and lower PEC fugitive emissions due to the combined effect of PROVEN system and better capture of pushing emissions with the integrated hood as well as lower soaking emissions due to the PROven® system.

VOC emissions will decrease by 10.7 TPY, mostly due to lower amounts of COG combusted and better control of PEC fugitives.

The following tables (**Table 3-6 and 3-7**) summarize the netting analysis for the hazardous air pollutants (HAPs) emitted during the various operations of a coke oven battery. The net change in lead is -3.002E-04 TPY and in Total Reduced Sulfur (TRS) is -148.8 TPY. The total net change in HAPs is -20.2 TPY, which indicates that there is a net decrease in HAPs from the C Battery replacement, project. In conclusion, this project will not trigger PSD review for any HAP.

Table 3-6 Netting analysis for the Main Hazardous Air Pollutants

| 7-9 Batteries            | Lead        |           | Hydrogen Sulfide |            | Carbon Disulfide |            | Total Reduced Sulfur |            |
|--------------------------|-------------|-----------|------------------|------------|------------------|------------|----------------------|------------|
|                          | lb/ton coal | tons/year | lb/ton coal      | tons/year  | lb/ton coal      | tons/year  | lb/ton coal          | tons/year  |
| PEC BH                   | 1.530E-05   | 9.365E-03 |                  |            | 4.200E-05        | 2.568E-02  |                      | 2.57E-02   |
| Traveling                | 1.530E-06   | 9.365E-04 |                  |            | 4.220E-06        | 2.580E-03  |                      | 2.58E-03   |
| PEC fugitives            | 2.609E-06   | 1.634E-03 |                  |            | 5.750E-06        | 3.516E-03  |                      | 3.52E-03   |
| Uncontrolled pushing     | 5.480E-05   | 1.833E-04 |                  |            | 4.800E-05        | 1.605E-04  |                      | 1.61E-04   |
| Quenching                |             |           |                  |            | 5.490E-03        | 3.357E+00  |                      | 3.36E+00   |
| 7-9 STACK TOTAL          |             |           |                  |            | 3.150E-03        | 5.27E-03   |                      | 5.27E-03   |
| Ball Mill                |             |           |                  |            |                  |            |                      |            |
| Soaking                  |             |           | 4.300E-01        | 2.629E+02  |                  |            |                      | 2.63E+02   |
| Decarbonization          |             |           |                  |            |                  |            |                      |            |
| Fugitives                |             |           | EF               | TPY        | EF               | TPY        |                      | TPY        |
| Doors                    |             |           | 0.138            | 0.138      | 0.001            | 0.001      |                      | 1.72E+01   |
| Lids                     |             |           | 4.800E-03        | 4.800E-03  | 3.200E-05        | 3.200E-05  |                      | 4.83E-03   |
| Offtakes                 |             |           | 4.770E-03        | 4.770E-03  | 3.200E-05        | 3.200E-05  |                      | 4.80E-03   |
|                          |             |           | sec/chg          | tons/year  | sec/chg          | tons/year  |                      | tons/year  |
| Charging                 |             |           | 5.600E-01        | 1.423E+01  | 1.180E-01        | 2.998E+00  |                      | 1.72E+01   |
| TOTAL                    |             | 1.201E-02 |                  | 2.773E+02  |                  | 6.393E+00  |                      | 3.008E+02  |
|                          |             |           |                  |            |                  |            |                      |            |
| C Battery                | lb/ton coal | tons/year | lb/ton coal      | tons/year  | lb/ton coal      | tons/year  | lb/ton coal          | tons/year  |
| PEC BH                   | 1.530E-05   | 1.052E-02 |                  |            | 4.200E-05        | 2.887E-02  |                      | 2.89E-02   |
| Traveling                | 9.088E-07   | 6.248E-04 |                  |            | 2.507E-06        | 1.723E-03  |                      | 1.72E-03   |
| PEC fugitives            | 1.530E-06   | 1.052E-03 |                  |            | 5.750E-06        | 3.953E-03  |                      | 3.95E-03   |
| Uncontrolled pushing     | 5.480E-05   | 1.134E-04 |                  |            | 4.570E-05        | 9.453E-05  |                      | 9.45E-05   |
| Quenching                |             |           |                  |            | 5.254E-03        | 3.612E+00  |                      | 3.61E+00   |
| C STACK                  |             |           |                  |            | 2.363E-03        | 7.23E-03   |                      | 7.23E-03   |
| Ball Mill                |             |           |                  |            |                  |            |                      |            |
| Soaking                  |             |           | 2.150E-01        | 1.482E+02  |                  |            |                      | 1.48E+02   |
| Decarbonization          |             |           |                  |            |                  |            |                      |            |
| Fugitives                |             |           | EF               | TPY        | EF               | TPY        |                      | TPY        |
| Doors                    |             |           | 0.069            | 0.035      | 0.000            | 0.000      |                      | 3.47E-02   |
| Lids                     |             |           | 4.320E-03        | 3.888E-03  | 2.880E-05        | 2.592E-05  |                      | 3.91E-03   |
| Offtakes                 |             |           | 4.293E-03        | 3.864E-03  | 2.880E-05        | 2.592E-05  |                      | 3.89E-03   |
|                          |             |           | sec/chg          | tons/year  | sec/chg          | tons/year  |                      | tons/year  |
| Charging                 |             |           | 5.600E-01        | 1.717E+01  | 1.180E-01        | 2.998E+00  |                      | 2.02E+01   |
| TOTAL                    |             | 1.231E-02 |                  | 1.483E+02  |                  | 3.654E+00  |                      | 1.519E+02  |
|                          |             |           |                  |            |                  |            |                      |            |
| NET CHANGE (C minus 7-9) |             | 3.002E-04 |                  | -1.290E+02 |                  | -2.739E+00 |                      | -1.468E+02 |

Table 3-7 Netting analysis for Other Hazardous Air Pollutants

| Pollutant           | Net Change      | PSD Applicability |
|---------------------|-----------------|-------------------|
| 1,1-Biphenyl        | 0.0006          | NO                |
| Ammonia             | -15.5076        | NO                |
| Anthracene          | 0.0034          | NO                |
| Antimony            | -0.2810         | NO                |
| Benzo(a) Anthracene | 0.0004          | NO                |
| Benzene             | -0.2503         | NO                |
| Chromium Compounds  | -2.8041         | NO                |
| Chlorine            | -0.0216         | NO                |
| Hydrochloric acid   | -0.9087         | NO                |
| Chrysene            | 0.0019          | NO                |
| Cobalt              | -0.1432         | NO                |
| Coke Oven Emissions | 0.0274          | NO                |
| Cresols             | 0.0271          | NO                |
| Cyanide Compounds   | 0.1094          | NO                |
| Dibenzofuran        | 0.0020          | NO                |
| Ethylbenzene        | 0.0000          | NO                |
| Ethylene            | -0.0209         | NO                |
| Fluoranthene        | 0.0019          | NO                |
| Mercury             | -0.0014         | NO                |
| Naphthalene         | -0.1718         | NO                |
| Nickel              | -0.3523         | NO                |
| Phenanthrene        | 0.0043          | NO                |
| Phenol              | 0.1173          | NO                |
| 7-PAH               | 0.0006          | NO                |
| POM                 | -0.0044         | NO                |
| Pyrene              | 0.0016          | NO                |
| Quinoline           | 0.0019          | NO                |
| Styrene             | 0.0000          | NO                |
| Toluene             | -0.0186         | NO                |
| Xylene              | -0.0023         | NO                |
| <b>TOTAL</b>        | <b>-20.1885</b> | <b>NO</b>         |

### **3.3 Federal Regulations**

#### ***National Emission Standards for Hazardous Air Pollutants for Source Categories***

##### **40 CFR Part 63, Subpart L: National Emission Standards for Coke Oven Batteries**

Subpart L sets standards for fugitive emissions from coke oven doors, topside port lids, offtake systems, charging and collecting mains. The standard requires the installation of a flare for each battery so that coke oven emissions are not vented to the atmosphere through by-pass bleeder stacks, except through the flare system. It also specifies work practice standards for the operation and maintenance of coke batteries.

##### **40 CFR Part 63, Subpart CCCCC: National Emission Standards for Coke**

###### **Ovens: Pushing, Quenching, and Battery Stacks (Compliance required by**

**April 14, 2006)**

This subpart sets emission standards and work practice standards for coke pushing, coke quenching and coke C Battery Combustion (underfire) stacks. These standards were effective April 14, 2006.

### **3.4 Commonwealth of Pennsylvania Regulations**

Article XXI of the Allegheny County Health Department Rules and Regulations incorporates the General Plan Approvals and Operating Permit requirements of the PA Department of Environmental Quality Board and Department of Environmental protection under the Pa. Air Pollution Control Act at 25 Pa. Code §§ 127.611 through 127.622.

### **3.5 Summary of Applicable Emission Limits and Work Practice Standards**

The following table summarizes ACHD and Federal emission limits and work practice standards applicable to the Project.

Federal and ACHD Article XXI Regulations

| Regulatory Citation                                 | Regulated Pollutant | Operation                              | Applicable Standard/Requirement   |
|---|---------------------|--|---|
| 40 CFR Part 63 - Subpart L<br>63.304(b)(2)(iv)      | Visible Emissions   | Charging                               | 12 seconds / charge log average for 5 charges/30-day rolling average  |
| 40 CFR Part 63 - Subpart L<br>63.304(b)(3)(i)       | Visible Emissions   | Door Leaks                             | 4.0% leaking doors per battery/30-day rolling average   |
| 40 CFR Part 63 - Subpart L<br>63.304(b)(2)(ii)      | Visible Emissions   | Lid Leaks (charging ports)             | 0.4% leaking lids/30-day rolling average  |
| 40 CFR Part 63 - Subpart L<br>63.304(b)(2)(iii)     | Visible Emissions   | Offtake Leaks                          | 2.5% leaking offtakes/30-day rolling average  |
| 40 CFR Part 63 - Subpart L<br>63.308(a) through (d) | Visible Emissions   | Collector Mains                        | Monitor Daily, Record the time & date leak is observed, time and date leak was temporarily sealed, Temporary seal within 4 hours, Initiate permanent repair within 5 days, Complete repair within 15 days |
| 40 CFR Part 63 - Subpart L<br>63.306                | Visible Emissions   | Work Practices                         | Implement after 2 exceedances in 6 mos.<br><br>& then for 90 days   |
| 40 CFR Part 63 - Subpart L<br>63.307                | Visible Emissions   | ByPass / Bleeder Stacks<br><br>(Flare) | Install Flares/ Prohibition of venting, flare requirements  |
| 40 CFR Part 63 - Subpart L<br>63.310                | NA                  | Startup, Shutdown, Malfunction         | Startup, Shutdown, Malfunction: operate and maintain battery and equipment consistent with good air pollution control practices to minimize emissions, develop and implement SSM Plan.                    |
| 40 CFR Part 63 - Subpart L<br>63.311                | NA                  | Reporting & Recordkeeping              | Perform specified reporting and recordkeeping requirements  |

|  |                      |                                       |  |
|--|----------------------|---------------------------------------|--|
| 40 CFR Part 63 – Subpart CCCCC 63.7290           | Particulate Matter   | PEC BH                                | 0.02 lb / ton of coke if moveable hood used (EPA Method 5 front half)  |
| 40 CFR Part 63 – Subpart CCCCC 63.7291           | Opacity              | Ovens                                 | Perform specified observations, recording of fugitive pushing emission; corrective action if necessary                               |
| 40 CFR Part 63 – Subpart CCCCC 63.7294           | NA                   | Soaking Work Practice                 | Operate according to written work practice plan  |
| 40 CFR Part 63 – Subpart CCCCC 63.7295           | Water Quality        | Quenching                             | TDS <=1,100 mg/;   |
| 40 CFR Part 63 – Subpart CCCCC 63.7295           | NA                   | Quench Tower Design and Work Practice | <=5% of area open to sky; baffle washing & inspection & repair frequency   |
| 40 CFR Part 63 – Subpart CCCCC 63.7296           | Opacity              | Battery Stacks                        | Daily <=15% normal coking cycle; daily <=20% extended coking cycle   |
| 40 CFR Part 63 – Subpart CCCCC 63.7300           | NA                   | Work Practice                         | Written operation & Maintenance plan; corrective action if bag leak detection system alarm triggered                                 |
| 40 CFR Part 63 – Subpart CCCCC 63.7320 – 63.7343 | NA                   | Compliance                            | Procedures for initial performance testing and ongoing compliance, recordkeeping, reporting  |
| 2105.21(g)                                       | NA                   | Quenching                             | Coke must be quenched through a baffled tower and water must be of the same quality as the nearest stream or from the nearest stream |
| 2105.21(h)(2)                                    | H2S                  | COG Combustion                        | H <sub>2</sub> S must be less than 10 gr/100 dcf   |
| 2108.02(b)                                       | SO <sub>2</sub> & PM | Underfire Stacks                      | Conduct biennial testing   |
| 2105.21(a)(1)                                    | Visible Emissions    | Charging                              | 55 seconds total for 5 charges   |
| 2105.21(b)(4)                                    | Visible Emissions    | Door Leaks                            | 40% Visible Emissions, at any time 15 minutes after charge   |
| 2105.21(b)(1)                                    | Visible Emissions    | Door Leaks                            | 5% leaking minus the two door areas of last oven charged and any oven door obstructed from view.                                     |
| 2105.21(c)(1)                                    | Visible Emissions    | Lid Leaks (charging ports)            | 1% leaking lids  |

|                  |                   |                        |  |
|------------------|-------------------|------------------------|--|
| 2105.21(d)(2)    | Visible Emissions | Offtake Leaks          | 4% leaking offtakes  |
| 2105.21(e)       | PM                | Pushing                | Install PEC to reduce emissions (use BACT)                                 |
| 2105.21(e)(4)    | Visible Emissions | Pushing                | Pushing or PEC outlet - not to equal or exceed 20% at any time             |
| 2105.21(e)(5)    | Visible Emissions | Pushing                | Coke transport - not to exceed 10% at any time                             |
| 2105.21(e)(6)    | Visible Emissions | Pushing                | PM-10 SIP Contingency Plan; implement 30 days after notification from ACHD |
| 2105.21(e)(3)(E) | PM                | Pushing - BH Stack     | 0.040 lbs/ton of coke  |
| 2104.05          | Visible Emissions | Baghouse Dust Handling | No emissions visible at or beyond the property line.                       |
| 2105.21(f)(4)    | Visible Emissions | Underfire stack        | 60% Visible Emissions at anytime   |
| 2105.21(f)(3)    | Visible Emissions | Underfire stack        | 20% Visible Emissions 3 mins/hr  |
| 2105.21(f)(1)    | Particulate       | Underfire stack        | 0.015 grains/ DSCF   |
| 2104.03(c)       | SO2               | Underfire stack        | 500 ppm (vol dry) in effluent gas  |
| 2108.03(b)       | NOx               | Underfire stack        | Install & operate continuous NOx emission monitor                          |
| 2109.03          | Visible Emissions | Underfire stack        | Install & operate Continuous Opacity Monitor                               |



## 4.0 Best Available Control Technology Analysis

As stated in **Section 3.1**, among the requirements that must be met to comply with ACHD Installation Permit requirements is a demonstration that the Best Available Control Technology (BACT) will be applied to the emissions units that will be constructed or modified in conjunction with this project. The emissions-generating activities and pollutants for which BACT applies for this project are as follows:

- C Battery Coking Cycle  
COG Combustion ..... NO<sub>x</sub>, VOCs, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>
- C Battery Pushing ..... NO<sub>x</sub>, VOCs, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>
- C Battery Fugitives ..... NO<sub>x</sub>, VOCs, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>
- C Battery Traveling ..... NO<sub>x</sub>, VOCs, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>
- C Battery Quench Tower ..... VOC, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>
- C Battery Coke Handling ..... TSP, PM<sub>10</sub> and PM<sub>2.5</sub>

Separate assessments were made for each emissions unit subject to BACT, and each pollutant subject to BACT was considered separately except for particulate matter (TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>) for which the feasibility, costs, and other considerations pertaining to available control options are the same and which were therefore addressed collectively. It is noted here that in reference to control of PM<sub>2.5</sub> emissions, PM<sub>10</sub> emissions are regulated as a surrogate.

A BACT determination analysis was not performed for the following emissions units:

- The emergency flare system that will be associated with the C Battery will be operated and equipped to meet Lowest Achievable Emission Rate (LAER) requirements for emergency flares. The flare is required to apply LAER by virtue of being a new source that is subject to the Maximum Achievable Control Technology (MACT) requirements for coke oven batteries set forth in 40 CFR Part 63, Subpart L, the National Emissions Standards for Hazardous Air Pollutants for Coke Oven Batteries (see §63.307). All new sources that are subject to a MACT standard must apply what USEPA determined represented LAER when the applicable standards were promulgated. A review of the current state-of-the-art for emergency flares was performed, and this showed that current LAER remains as specified in the Subpart L MACT standards. The flare will also be subject and will meet the New Source Performance Standards (NSPS) for flares set forth by USEPA in 40 CFR Part 60, Subpart A (§60.18). Because the emergency flare is required to apply LAER, a BACT determination analysis was not performed for that emissions unit.
- Other process operations at the Clairton Plant that may be tangentially affected by the operation of the proposed new C Battery, including coal handling, wastewater treatment, methanol storage, and, most notably, the byproducts recovery process, are not subject to BACT because there will be no physical change or change to the method of operations of those operations as a result of this project. Since BACT does not apply to these other emissions units, a BACT determination analysis was not performed for them.

To meet the BACT demonstration requirement, on behalf of U.S. Steel, ENSR Corporation (ENSR) performed an air quality engineering analysis to determine BACT for each of the emissions units and pollutants listed above. The approach taken and the findings and conclusions of this analysis are discussed below.

## **4.1 BACT Assessment Approach**

In accordance with USEPA and ACHD guidance, BACT was determined through a "top-down" assessment that started with LAER and proceeded through consideration of progressively lesser levels of control. As permitted by USEPA and ACHD, the determination of BACT took into account energy, environmental, and economic impacts associated with potentially applicable control options.

As indicated above, separate assessments were made for each emissions unit subject to BACT, and each pollutant subject to BACT was considered separately except for particulate matter (TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>).

### **4.1.1 Identification of Available Control Technology Options**

The first step for these assessments was to identify the emissions control technology options and associated emissions levels to be evaluated. The identification of emissions control technology options included consideration of transferable and innovative control measures that may not have previously been applied to the types of emissions units that will be operated at the project.

In order to identify emissions control technology options for the project, a search of the USEPA's RACT/BACT/LAER Clearinghouse<sup>1</sup> (RBLC) was performed. The information obtained through the RBLC search was supplemented by information obtained from USEPA Region V, the California Air Resources Board Statewide BACT Clearinghouse<sup>2</sup>, and permit databases provided to the public by a number of other state agencies. Information obtained regarding recent emissions control technology determinations for the emissions units associated with the project is summarized in information presented in each relevant subsection.

The primary source of information concerning the control of emissions for coke oven batteries was the USEPA's "Background Information for Proposed Standards" (referred to here as USEPA's BID) for the development of the standards under 40 CFR Part 63, Subpart CCCCC, the NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks<sup>3</sup>. Additional information was obtained from a 1983 study conducted by GCA Corporation on behalf of USEPA<sup>4</sup>.

The information collected relevant to coke oven battery emissions controls and limits is summarized in Appendix E.

### **4.1.2 Ranking of Technically Feasible Control Technology Options**

The second step for these assessments was to compile, based on the findings of the research effort described above, a list of emissions control technology options for each of the emissions units associated with the project. For each option that was identified, an engineering analysis was then conducted to determine the technical feasibility of its application to the specific emissions units associated with the project. Those options that were found to be infeasible for this application were eliminated.

After the elimination of technically infeasible control technologies, the remaining options were ranked in order of the level of control that could be achieved by applying them to the specific emissions units associated with the project, establishing the top-down order for the subsequent analyses.

The ranking of options started with the establishment of the baseline, i.e., the minimum allowable level of control. The minimum allowable level of control is equivalent to the most stringent applicable and relevant federal, state, and local emissions standard. In each subsection, the BACT baseline, consisting of the applicable control requirements and emissions limits under NSPS, NESHAPs, and state and local Reasonably Available Control Technology (RACT) and other emission standards, is summarized for each emissions unit-pollutant identified above.

To go beyond the BACT baseline to determine the ranking of technically feasible emissions control options for C Battery, information was obtained from USEPA's BID, the RBLC, California BACT Clearinghouse, and from other literature obtained by U.S. Steel and ENSR in the research effort described above. Most of the information found was from USEPA's BID, and accordingly, the establishment of a ranking for these assessments took into account the following factors identified in USEPA's BID as those which "most affect[ing] emissions and control costs for pushing, quenching, and battery stacks":

- Overall Battery Condition
- Non-recovery versus byproduct recovery process
- Foundry versus furnace coke
- Short (less than 5 meters) versus tall (5 meters or more) oven height.

To explain these points further, the differences between non-recovery and byproduct recovery battery designs will translate to significant differences in the technical feasibility, costs, and other impacts applicable to a given control technology option, and therefore controls that were found to be applied only to non-recovery batteries were not generally considered transferable to the proposed C Battery. As discussed in detail in **Section 4.4**, however, consideration was given to employing a non-recovery design as an emissions reduction alternative for minimizing battery fugitives. The differences between the proposed C Battery, which will employ tall ovens to produce furnace coke only, and batteries that produce foundry coke and batteries that employ short ovens, were also considered important in the evaluation of the transfer of technologies. For example, production of foundry coke generally involves a significantly longer coking cycle than is employed to produce furnace coke, and therefore the costs and cost-effectiveness of a control technique applied only to foundry coke batteries will be appreciably different from the economics of that type of control to the proposed C Battery.

In most cases, however, there was no basis found for quantifying the amount of emissions control that could be achieved by the emissions control options that were identified for this specific application to the C Battery. Therefore, the ranking of options for these assessments was generally done on a qualitative, and not quantitative, basis.

Once the top-down order for the assessments was established, the options were assessed following that ranking. In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control (i.e., LAER) was acceptable, no further analysis was required. In other cases, when associated environmental, economic, and/or economic impacts precludes the use of LAER, the top-down order for the analysis was followed until a technology without unacceptable associated impacts was identified.

#### **4.1.3 Environmental Impact Analysis**

Except as indicated below, an environmental impact analysis was performed for each technically feasible control technology option. The primary focus of the environmental impact analysis was the assessment of the reduction in ambient concentrations of the air contaminant being controlled. To account for this, judgments (and in some cases, estimates) were made of the increases or decreases in emissions of other criteria or non-criteria air contaminants that may be associated with the control technology options. For example, increased emissions of particulate matter and ammonia associated with post-combustion NO<sub>x</sub> emissions controls considered for the coking cycle COG combustion system were judged to be adverse environmental impacts. In addition, consideration was made of non-air impacts, such as the generation by a control technology option of solid waste requiring disposal or wastewater requiring treatment.

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no environmental analysis was performed.

#### 4.1.4 Energy Impact Analysis

Except as indicated below, an energy impact analysis was performed for each technically feasible emissions control technology option. For this assessment, energy impact was defined as the amount of energy that would be consumed by the option itself, i.e., energy consumption by equipment or operating activities that would only be consumed to support the operation of the control technology. The impact of a control option on the energy efficiency of the emissions units could also be considered an energy impact, but this type of quantity was not estimated in this assessment.

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no energy analysis was performed.

#### 4.1.5 Economic Impact Analysis

Except as indicated below, an economic impact analysis was performed for each technically feasible emissions control technology option. Economic impact is defined in terms of overall cost-effectiveness, i.e., the ratio of the potential dollar cost of the option to the number of tons of emissions reduction it will potentially achieve. The cost of option includes both the capital cost of equipment and annual operating costs. The total annualized cost of control is determined by amortizing the total capital cost based on the following parameters (these are values that ENSR has typically employed in estimating economic impact for BACT determinations):

- 20 years economic life
- 8% interest rate

In cases where either there was only one feasible option or U.S. Steel determined that the most stringent level of control was acceptable, no economic analysis was performed.

As discussed above, in most cases, it was not possible to quantify the amount of emissions control that could be achieved by the options being evaluated. Consequently, it was not possible to estimate economic impact on a \$/ton basis for most of the options that were assessed. In some cases economic impact was either judged based on overall cost or on a qualitative basis only, or was not considered in determining BACT.

## 4.2 BACT for C Battery Coking Cycle COG Combustion

This section addresses BACT specifically for the coking cycle COG combustion emissions, i.e., the products of the combustion of COG within the heating flues. As discussed in **Section 2.2.3**, during the coking cycle, emissions that are generated also include emissions from charging, soaking and decarbonization, fugitive COG that leaks from coke oven doors, lids, and offtakes. The BACT assessment for the C Battery fugitives that occur during the coking cycle is discussed in **Section 4.4**.

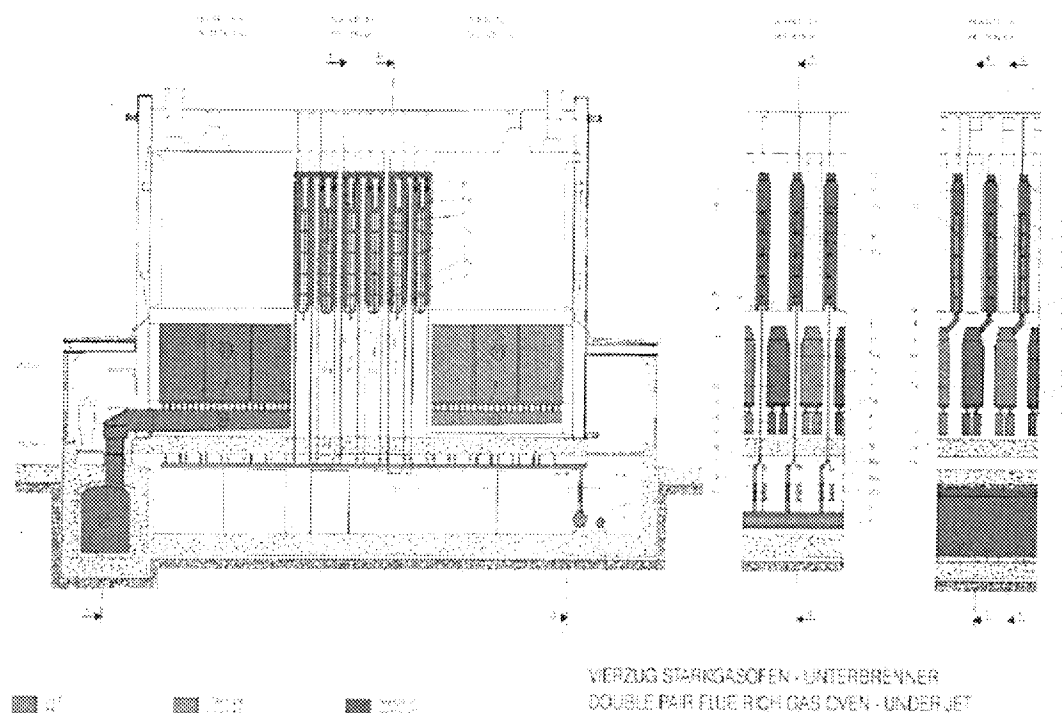
As indicated in **Table 2-1**, COG combustion during the coking cycle is the largest source of emissions associated with coke oven battery operation. A diagram of the proposed combustion system is shown below in **Figure 4-1**:

### 4.2.1 Proposed C Battery Coking Cycle Combustion Emissions Control Technologies

The proposed approach for the minimization of these emissions includes:

- Emissions of all pollutants will be minimized through the employment of the PROven® system, combined with effective operating and maintenance procedures that will comply with applicable NESHAPs requirements. The PROven® system will be especially effective in minimizing oven-to-flue leakage, thus reducing emissions of VOCs, CO, TSP, SO<sub>2</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>.

Figure 4-1 Coking Cycle COG Combustion System



Source: Uhde Corporation of America, a company of ThyssenKrupp USA, Inc.

- NO<sub>x</sub> emissions will be minimized through the employment of a combination of three technologies. One is the PROven® system, the second is the removal of nitrogen-containing compounds in the Clairton Plant byproduct recovery system, and the third is the staging of combustion in the heating flues.

The Clairton Plant byproduct recovery system includes a unique cryogenic process that is extremely efficient in removing nitrogen-bearing organic compounds such as pyridine, and a desulfurization process that includes an "HCN Destruct" unit to remove HCN, from the COG. The Clairton byproduct plant has a record of both high reliability and high efficiency.

The staged combustion system will be similar to an overfire air (OFA) system employed for NO<sub>x</sub> emissions minimization in large-sized boilers. Excess oxygen in the combustion zone will be minimized by feeding part of the combustion air to the bottom of the heating flues, resulting in a first stage of combustion in a fuel-rich environment. Combustion will be completed by adding additional combustion air through a series of additional airports at different elevations along the height of the flue. This will enable proper vertical wall temperature distribution together with reduced NO<sub>x</sub> levels in the waste gas. A key component of this system design that will contribute to minimizing NO<sub>x</sub> emissions will be the regenerators, which are heat exchangers situated beneath the ovens and heating flues that will recover heat from the exhaust gas exiting the heating flues and use it to preheat the combustion air. The staged combustion system that will be employed constitutes, and is therefore described as, low-NO<sub>x</sub> burner (LNB) technology.

- VOC and CO emissions will be minimized through the employment of the PROven® system in combination with the LNB-staged combustion system, which is the most efficient COG combustion system available.
- SO<sub>2</sub> emissions will be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and the removal of sulfur from COG in the byproduct plant. Because the byproduct

plant is designed to recover sulfur to yield a saleable product, the Clairton process is designed to achieve the highest feasible levels of sulfur removal from the COG. The byproduct plant sulfur removal process yields an average hydrogen sulfide (H<sub>2</sub>S) concentration of approximately 12 grains per 100 dry cubic feet (gr/100 dcf) in COG used as fuel for the coke oven heating flues. As noted above, the Clairton byproduct plant has a record of both high reliability and high efficiency.

- TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions, which are largely attributable to the presence of sulfur compounds in the COG being burned, will also be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and removal of sulfur from COG in the byproduct plant.

#### **4.2.2 BACT Baseline - Applicable Emissions Control Standards for Coking Cycle COG Combustion**

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for COG combustion during the coking cycle, which are as follows:

- There are no NSPS applicable to coking cycle COG combustion. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, specifies only limits on visible emissions for coking cycle COG combustion, in §63.7296. It is noted here that since the battery stacks are included in the affected source category definition for Subpart CCCCC, coking cycle COG combustion is not subject to any other NESHAPs, in particular the NESHAPs for Industrial, Commercial, and Institutional Boilers and Process Heaters.
- For NO<sub>x</sub>, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO<sub>x</sub> RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21. A continuous emissions monitoring system (CEMS) for NO<sub>x</sub> is required under ACHD §2108.03(b) and 25 PA Code §§139.101 – 139.111.
- For SO<sub>2</sub>, ACHD §2105.21(h)(2) specifies a H<sub>2</sub>S emissions limit of 10 gr/100 dcf for coke oven batteries installed, replaced, or reconstructed, or at which a major modification is made on or after January 1, 1978. At actual stack temperature of approximately 440°F, this translates to an SO<sub>2</sub> emissions limit of approximately 276 ppmvd.
- For TSP, PM<sub>10</sub> and PM<sub>2.5</sub>, ACHD §2105.21(f) specifies a limit of 0.015 grains per dry standard cubic foot (gr/dscf) for coke oven batteries installed, replaced, or reconstructed, or at which a major modification is made on or after January 1, 1978.

The proposed controls for the C Battery will comply in full with all of these applicable requirements.

#### **4.2.3 State-of-the-Art for Emissions Control for Coking Cycle COG Combustion**

As presented in **Appendix E-5**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to coke oven C Battery coking cycle COG combustion emissions control are as follows:

- A total of 57 coke oven batteries were identified that are either currently in operation or, in one case, Chicago Coke, are expected to operate in the future in the United States. This includes 12 non-recovery coke oven batteries, 34 short byproduct recovery coke oven batteries, and 11 tall byproduct recovery coke oven batteries.

- No emissions control technologies for reducing COG combustion emissions were explicitly identified for any of the 45 byproduct recovery coke oven batteries. More specifically, no other battery in the United States was found that employs either an electrostatic precipitator (ESP), baghouse, scrubber, flue gas desulfurization (FGD), selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), oxidation catalyst (OC), or other specific technology such as the PROven® system.
- The only emissions limits identified for any of the 45 byproduct coke oven batteries were for particulate matter and visible emissions. Under §63.7296(a), all batteries in the United States are now required to meet a daily average opacity limit of 15%.
- No emissions limits were found for any other pollutants for any of these batteries. COG sulfur content limits such as the one identified above under ACHD §2105.21(h)(2) are specified, however, for many, though not all, of the byproduct recovery batteries.
- For the 11 tall byproduct recovery coke oven batteries that were identified, the most stringent particulate matter emissions limit found was 0.012 gr/dscf, for the EEC Coke Battery, LLC Battery #5 in Ecorse, Michigan<sup>5</sup>. An examination of the requirements for that battery indicates, however, that the emissions limit is not as stringent as the limit that is being proposed for the C Battery, because the 0.012 gr/dscf value is based on excluding sulfates. As noted on page 13 of a February 7, 2006 report prepared for USEPA by RTI International<sup>6</sup>, entitled "Evaluation of PM<sub>2.5</sub> Emissions and Controls at Two Michigan Steel Mills and a Coke Oven Battery," "EES Coke is one of the few coke plants in the United States that does not desulfurize its coke oven gas before burning it in the underfiring system of the coke oven battery." Because the COG used by the EES battery is not desulfurized, it has an H<sub>2</sub>S content limit of 2.64 gr/dscf, which is more than 25 times higher than the H<sub>2</sub>S content limit for the C Battery (10 gr/100 dcf). If sulfate particulates were included for the EES battery, its emissions would be far higher than the proposed limit of 0.015 gr/dscf for the C Battery.
- The proposed limit of 0.015 gr/dscf for the C Battery is imposed on only two other tall byproduct recovery batteries, one of which is the Clairton Plant B Battery. Eight tall byproduct recovery batteries are subject to either a less stringent limit or no limit at all for particulate matter. Notably this includes the most recently permitted tall byproduct battery, at Chicago Coke, which has been permitted but has not yet built (and thus has not demonstrated compliance with its limits).
- For the 34 short byproduct recovery batteries, the proposed limit of 0.015 gr/dscf for the C Battery is imposed on only five batteries, four of which are Batteries 13, 14, 15, and 20 at the Clairton Plant (the other is Battery #1 at Shenango in Pittsburgh). There are 29 short byproduct recovery batteries that are subject to either a less stringent limit or no limit at all for particulate matter.

In summary, the proposed emissions controls and associated emissions limits for the coking cycle COG combustion emissions from the C Battery will equal the most stringent controls and limits applied to any tall byproduct recovery coke oven C Battery coking cycle COG combustion emissions in the United States.

#### **4.2.4 Top-Down Assessment of Control Technology Options for Coking Cycle COG Combustion**

##### **4.2.4.1 BACT for NO<sub>x</sub> Emissions**

###### **Identification of Available Control Technology Options**

NO<sub>x</sub> emissions from coking cycle COG combustion are attributable to the oxidation of nitrogen in the combustion air ("thermal NO<sub>x</sub>") and in the COG ("fuel NO<sub>x</sub>"). Thermal NO<sub>x</sub> is the predominant mechanism for NO<sub>x</sub> formation, due to the high combustion zone temperature requirements for coking cycle combustion, and also due to the relatively low nitrogen concentration in the COG being burned. Leakage of untreated COG

from the oven into the combustion flues results in fuel NO<sub>x</sub> emissions due to the nitrogen content of the untreated COG.

The following NO<sub>x</sub> emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant removal of nitrogen-containing compounds
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would either contain a lower nitrogen concentration or would burn at a lower temperature
- Low-NO<sub>x</sub> burners (LNBs)
- Flue gas recirculation (FGR)
- Catalytic combustion systems such as XONON™
- Selective catalytic reduction (SCR)
- Selective non-catalytic reduction (SNCR)
- Other post-combustion NO<sub>x</sub> emissions control technologies such as SCONOX™, catalytic adsorption, NO<sub>x</sub> absorbers, and ozone injection

#### **Technical Feasibility Assessment**

**The PROven® system** is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower NO<sub>x</sub> emissions because it will minimize overall fuel NO<sub>x</sub>.

**Byproduct recovery plant nitrogen compound removal** is technically feasible for this application. This too will directly result in lower NO<sub>x</sub> emissions because it will minimize overall fuel NO<sub>x</sub>.

**Fuel switching to natural gas** is technically feasible for this application, but would not result in lower NO<sub>x</sub> emissions than will be generated by burning the clean COG produced by the Clairton Plant byproduct recovery process. Combustion of natural gas will actually generate more emissions of NO<sub>x</sub> than combustion of the Clairton Plant clean COG because natural gas will contain more nitrogen than the Clairton Plant clean COG (which is in part due to the removal of nitrogen compounds in the Clairton Plant byproduct recovery system). Based on stack testing results for the Clairton Plant boilers, NO<sub>x</sub> emissions generated when natural gas is burned are on the order of 0.14 tons per million cubic feet of gas fired. In contrast, when clean COG is burned in those same boilers, NO<sub>x</sub> emissions are on the order of 0.054 tons per million cubic feet of gas fired<sup>7</sup>.

**Fuel switching to blast furnace gas** is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the C Battery.

**LNBs** are technically feasible for this application. As indicated above, the proposed staged combustion system to be employed by the C Battery constitutes an LNB technology.

**FGR** is not technically feasible for this application. FGR is widely applied to reduce NO<sub>x</sub> from conventional boilers, and is also employed in internal combustion engines, but has not been attempted, or based on



information in open literature, even studied, for a coke oven battery underfiring system. FGR helps minimize  $\text{NO}_x$  formation by reducing the primary combustion temperature and decreasing the concentration of oxygen in the combustion zone. The proposed COG combustion system LNB-staged combustion design, represents the optimal balance to ensure proper combustion efficiency, which is essential both for heating in the coking cycle and maintaining compliance with other battery stack emissions regulations. In addition, as discussed by MACTEC Engineering and Consulting, Inc.<sup>8</sup> in the July 2006 "Re-Evaluation of Reasonably Available Control Technology," FGR is not technically feasible for a coke oven C Battery combustion system, "due to the large volume of gas associated with the underfire system design coupled with the fuel heat input values that are required."

**Catalytic combustion systems** such as XONON™ are not technically feasible for this application. These types of systems, which have been applied to other types of combustion units such as combustion turbines, have not been attempted, or based on information in open literature, even studied, for a coke oven battery underfiring system. It is unlikely a catalytic combustor would be acceptable for COG combustion due to the sulfur content of the fuel. Although the byproduct plant is designed to maximize the recovery of sulfur from COG produced in the ovens, the sulfur level of the COG burned in the heating flues will still be high enough to present potential catalyst fouling and degradation. Since no research has been done for this type of application, the level and extent of such potential problems are unknown.

**SCR** is not technically feasible for this application. SCR is reportedly being studied, and was actually applied on a demonstration level basis between 1976 and 1992 at one facility in Japan<sup>9</sup> but is not known to have progressed beyond the demonstration level of development for a coke oven application. There are a number of issues concerning the technical feasibility of SCR for this type of application, as follows:

- First, and most significantly, the temperature of the exhaust gas exiting the heat exchanger section of the oven heating chamber will be approximately 450°F, which at best is at the low end of the temperature range in which the SCR functions (the "SCR temperature window"). Theoretically it is possible to either bypass the regenerator section of the coke oven C Battery combustion system, or to construct a reheat system to bring the exhaust gas temperature back to within the SCR temperature window, to allow this technology to be employed. However, the recovery of heat from the exhaust gas is a fundamental component of the overall  $\text{NO}_x$  emissions minimization design of the coke oven. An alteration of this to ensure that the exhaust gas stays in the SCR temperature window may result in an overall reduction in the efficiency of the generation of heat needed for the coking process, which in turn would result in the generation of more emissions, possibly more than would be reduced by the SCR. The same issues apply to an exhaust gas reheating system.
- A second issue concerning the technical feasibility of applying SCR to a coke oven combustion system is that the concentration of  $\text{NO}_x$  in the exhaust gas undergoes significant step changes as the underfiring system reverses. The catalyst activation energy and ammonia feed-forward system will not be capable of handling significant and instantaneous changes in  $\text{NO}_x$  concentration. The result will be periods in which the SCR will not reduce  $\text{NO}_x$  emissions effectively (or at all) and corresponding increases in ammonia slip emissions. Considering that the underfiring system reverses will occur approximately every twenty minutes, this is a significant issue.
- A third technical feasibility issue for SCR for this application is that the COG burned in the coke oven contains an appreciable amount of sulfur. Just as noted above in regard to the technical feasibility of catalytic combustion, although the byproduct plant is designed to maximize the recovery of sulfur from COG produced in the ovens, there will still be an appreciable amount of sulfur level in the clean COG. Just as is thought likely for the catalysts used for catalytic combustion systems, an SCR catalyst will be fouled and degraded by sulfur compounds in the clean COG, but the primary issue for SCR is not catalyst fouling and degradation but rather the generation of higher particulate emissions due to the formation of ammonium sulfate and bisulfate. Since SCR requires ammonia to eliminate  $\text{NO}_x$ , the reaction of ammonia with the sulfur in the clean COG is unavoidable. In addition to the effect of increasing particulate

emissions, ammonium bisulfate formation will lead to maintenance issues because it is a particularly corrosive and adherent substance.

- Finally, in contrast to the boilers, internal combustion engines, and combustion turbines for which SCR has reached relatively widespread application, the nature of the coke oven process does not lend itself well to the types of maintenance procedures and schedules that are used for those other types of sources when SCR is used.

**SNCR** is not technically feasible for this application. There are no known applications, even at a demonstration level, of the application of this technology to a coke oven C Battery combustion system, and there is no evidence indicating that this is or has ever been studied. SNCR requires both an exhaust temperature of at least 1,500°F and enough residence time at that temperature to allow the injected ammonia to mix with the exhaust gas and allow the NO<sub>x</sub> reduction reactions to come to completion. As discussed above relative to the feasibility of SCR, it is theoretically possible to construct a reheat system to bring the exhaust gas temperature back to within the SNCR temperature window, and provide sufficient residence time for the NO<sub>x</sub> reduction reactions, but doing so would result in an overall reduction in thermal efficiency and would likely result in the generation of more emissions than would be reduced by the SNCR, and since the application of this technology has not been demonstrated, it is quite possible that there are other technical feasibility issues that render this technology unworkable for this application.

**Other post-combustion NO<sub>x</sub> emissions control technologies** that are reportedly under development for other types of combustion units, such as SCONOx™, catalytic adsorption, NO<sub>x</sub> absorbers, and ozone injection, involve system designs that are very specific to those other types of units and which therefore are not considered to be applicable in this case.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available NO<sub>x</sub> emissions control options identified above, the PROven® system, byproduct recovery plant nitrogen compound removal, fuel switching to natural gas, and LNBs are all considered technically feasible for this application. Fuel switching to blast furnace gas, FGR, catalytic combustion, SCR, SNCR, SCONOx™, and other post-combustion NO<sub>x</sub> emissions control technologies are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing NO<sub>x</sub> emissions from C Battery coking cycle COG combustion is to combine the PROven® system, byproduct recovery plant nitrogen compound removal, and an LNB-staged combustion system. This is the system that is proposed for the C Battery.

Because, for reasons explained above, fuel switching to natural gas will not result in lower NO<sub>x</sub> emissions than will be generated by burning the clean COG produced by a byproduct recovery plant with nitrogen compound removal (even if natural gas combustion were used in combination with the PROven® system and LNBs), it was ranked below the proposed control technology and therefore was not assessed further in this analysis.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

#### **BACT Determination**

The proposed combination of the PROven® system, byproduct recovery plant nitrogen compound removal, and LNB-staged combustion system represents both BACT and LAER for NO<sub>x</sub> emissions control for C Battery coking cycle COG combustion.

No specific NO<sub>x</sub> emissions limit is proposed as BACT for the C Battery coking cycle COG combustion. Since NO<sub>x</sub> emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for coking cycle COG combustion set forth in §63.7296 represents the best means to ensure minimization of NO<sub>x</sub> emissions.

#### 4.2.4.2 BACT for VOC and CO Emissions

##### Identification of Available Control Technology Options

VOC and CO emissions from coking cycle COG combustion are both attributable to incomplete combustion of organic compounds in the COG. Oven-to-flue leakage is a particular issue in regard to formation of VOC and CO emissions in coking cycle COG combustion. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants is the same, BACT for both pollutants was addressed concurrently.

The following VOC and CO emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would either contain a lower nitrogen concentration or would burn at a lower temperature
- Oxidation catalysts (OCs)

##### Technical Feasibility Assessment

**The PROven® system** is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower VOC and CO emissions because it will reduce the organic compound concentration in the COG being burned in the heating flues

**Fuel switching to natural gas** is technically feasible for this application, but would not result in lower VOC or CO emissions than will be generated by burning the clean COG produced by the Clairton Plant byproduct recovery process. Natural gas combustion will actually generate more VOC and CO than the Clairton Plant clean COG combustion because while clean COG typically contains 50% to 65% hydrogen and 25% to 30% methane, natural gas typically contains 80% to 95% methane. The higher carbon content of natural gas translates to higher incomplete combustion of the carbon-containing constituents when it is burned, and thus higher VOC and CO emissions as compared to burning the Clairton clean COG.

**Fuel switching to blast furnace gas** is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the C Battery.

An **oxidation catalyst** is not technically feasible for this application. OCs are employed with some effectiveness for other types of combustion units such as combustion turbines, but have not have not been attempted, or based on information in open literature, even studied, for a coke oven battery underfiring system. It is in fact unlikely that this technology will be studied for this type of application because, as discussed in MACTEC's "Re-Evaluation of Reasonably Available Control Technology," the concentration of VOCs and CO in the combustion exhaust stream (estimated by MACTEC<sup>®</sup> on the order of 30 parts per billion, by volume, for VOCs) will likely be three orders of magnitude lower than the minimum level for which an oxidation catalyst is feasible. In addition, the same concerns discussed above for the application of catalytic combustion systems

and SCR to a coke oven, including catalyst poisoning and resultant maintenance and scheduling issues, and temperature window limitations, would apply as well for an CC.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available VOC and CO emissions control options identified above, the PROven® system and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and an oxidation catalyst are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing VOC and CO emissions from C Battery coking cycle COG combustion is to employ the PROven® system. This is the system that is proposed for the C Battery.

Because, for reasons explained above, fuel switching to natural gas will not result in lower VOC and CO emissions than will be generated by burning the clean COG produced by the byproduct recovery plant (even if natural gas combustion were used in combination with the PROven® system), it was ranked below the proposed control technology and therefore was not assessed further in this analysis.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

#### **BACT Determination**

The proposed combustion system design, featuring the PROven® system, represents both BACT and LAER for VOC and CO emissions control for C Battery coking cycle COG combustion.

No specific VOC or CO emissions limits are proposed as BACT for the C Battery coking cycle COG combustion. Since VOC and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for coking cycle COG combustion set forth in §63.7296 represents the best means to ensure minimization of VOC and CO emissions.

#### **4.2.4.3 BACT for SO<sub>2</sub> Emissions**

##### **Identification of Available Control Technology Options**

SO<sub>2</sub> emissions from coking cycle COG combustion are attributable to the oxidation of sulfur in the COG, and also to oven-to-flue leakage, where sulfur in untreated COG is oxidized.

The following SO<sub>2</sub> emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant desulfurization
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would have a lower sulfur content
- Flue gas desulfurization (FGD)

### **Technical Feasibility Assessment**

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower SO<sub>2</sub> emissions because it will minimize overall fuel sulfur content.

Byproduct recovery plant desulfurization is technically feasible for this application, and will be employed to treat the COG fired in the C Battery. As indicated above, because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton Plant process is designed to achieve the highest feasible levels of sulfur removal from the COG.

Fuel switching to natural gas is technically feasible for this application. This was addressed as an option to byproduct recovery plant desulfurization.

Fuel switching to blast furnace gas is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in the C Battery.

FGD is not considered technically feasible for this application. The reason for this is based on the problems with flue gas emissions control technology that was encountered by the coke oven batteries that employed them in the past, including the Clairton Plant's 21 Battery. The following facts were the basis for making the judgment that an FGD system is not technically feasible in this case:

- According to page 3-17 of USEPA's BID<sup>3</sup>, "[A]lthough some coke oven batteries had add-on devices (such as baghouses and electrostatic precipitators) on their stacks in the late 1970s to 1980s, they are no longer in use today."
- The Clairton Plant was one of the few mills at which a coke oven battery employing an ESP to control combustion stack emissions was located. The experience with this device, installed on 21 Battery, is likely indicative of the other batteries where this was tried. The 21 C Battery combustion stack ESP was removed from service many years ago due to high maintenance and energy requirements and costs - the downtime for that unit was approximately 50%.
- As noted by RTI International<sup>6</sup> "[N]o U.S. coke batteries use an add-on control device to control emissions from a combustion stack" (see page 15).
- In the establishment of the MACT requirements for new batteries, which by definition must represent LAER, USEPA determined that neither an ESP, fabric filter, nor a scrubber should be required. If a flue gas emissions control technology capable of controlling emissions of hazardous air pollutants, including a scrubber, was considered by USEPA to be technically feasible, they would have specified this as LAER and new source MACT. The fact that they did not make this determination is proof that USEPA agrees that such a device is not technically feasible for application to a byproduct coke oven C Battery coking cycle COG combustion system.

### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available SO<sub>2</sub> emissions control options identified above, the PROven® system, byproduct recovery plant desulfurization, and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and FGD are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing SO<sub>2</sub> emissions from C Battery coking cycle COG combustion is to employ the PROven® system in combination with fuel switching to natural gas. Pipeline

quality natural gas has a typical sulfur content on the order of 0.5 gr/100 dcf while the clean COG produced at the Clairton Plant will meet an H<sub>2</sub>S concentration limit of 10 gr/100 dcf.

The next-most effective available option option for minimizing SO<sub>2</sub> emissions from C Battery coking cycle COG combustion is to employ the PROven® system in combination with byproduct recovery plant desulfurization. For reasons explained below, this is the system that is proposed for the C Battery.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Switching to natural gas firing in combination with the PROven® system represents the top-ranked SO<sub>2</sub> emissions control technology option. As discussed previously, however, natural gas combustion will actually generate more NO<sub>x</sub>, VOCs, and CO than the Clairton clean COG combustion because natural gas will contain more nitrogen and methane than the Clairton Plant clean COG. This is considered an unacceptable environmental impact, and on that basis, switching to natural gas was rejected as BACT for this application.

The use of the byproduct recovery desulfurization process in combination with the PROven® system, which is the next-highest ranked technically feasible control technology option for SO<sub>2</sub> emissions from coking cycle COG combustion, was selected for this application.

#### **BACT Determination**

The proposed byproduct recovery desulfurization process in combination with the PROven® system represents BACT for SO<sub>2</sub> emissions control for C Battery coking cycle COG combustion.

The applicable H<sub>2</sub>S concentration limit of 10 gr/100 dcf is also proposed as a BACT requirement for the C Battery coking cycle COG combustion.

#### **4.2.4.4 BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> Emissions**

##### **Identification of Available Control Technology Options**

TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from coking cycle COG combustion are also attributable to the oxidation of sulfur in the COG, and also to oven-to-flue leakage, where sulfur in untreated COG is oxidized.

The following TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- Byproduct recovery plant desulfurization
- Fuel switching, from COG to natural gas, blast furnace gas, or some combination of fuels that would have a lower sulfur content
- Flue gas emissions control technology, including either a baghouse, electrostatic precipitator (ESP), scrubber, or some combination of those types of devices

#### **Technical Feasibility Assessment**

The PROven® system is technically feasible for this application. As indicated above, among the benefits of the PROven® system is that it will be especially effective in minimizing oven-to-flue leakage, and this will directly result in lower TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions because it will minimize overall fuel sulfur content.

**Byproduct recovery plant desulfurization** is technically feasible for this application, and will be employed to treat the COG fired in C Battery. As indicated above, because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton Plant process is designed to achieve the highest feasible levels of sulfur removal from the COG.

**Fuel switching to natural gas** is technically feasible for this application. This was addressed as an option to byproduct recovery plant desulfurization.

**Fuel switching to blast furnace gas** is not technically feasible for this application. Blast furnace gas is not available at the Clairton Plant for use in C Battery.

**Flue gas emissions control technology** is not considered technically feasible for this application, for the same reasons as discussed in Section 4.2.4.3 in reference to SO<sub>2</sub> emissions control. It is noted here that in addition to its other problems, the Clairton Plant 21 C Battery combustion stack ESP was found to be relatively ineffective in control TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control options identified above, the PROven® system, byproduct recovery plant desulfurization, and fuel switching to natural gas are considered technically feasible for this application. Fuel switching to blast furnace gas and flue gas emissions control technology are considered not technically feasible for this application, and were not assessed further in this analysis.

The most effective available option for minimizing TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery coking cycle COG combustion is to employ the PROven® system in combination with fuel switching to natural gas. Pipeline quality natural gas has a typical sulfur content on the order of 0.5 gr/100 dcf while the clean COG produced at the Clairton Plant will meet an H<sub>2</sub>S concentration limit of 10 gr/100 dcf.

The next-most effective available option for minimizing TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery coking cycle COG combustion is to employ the PROven® system in combination with byproduct recovery plant desulfurization. For reasons explained below, this is the system that is proposed for the C Battery.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Switching to natural gas firing in combination with the PROven® system represents the top-ranked TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control technology option. As discussed previously, however, natural gas combustion will actually generate more NO<sub>x</sub>, VOCs, and CO than the Clairton clean COG combustion because natural gas will contain more nitrogen and methane than the Clairton Plant clean COG. This is considered an unacceptable environmental impact, and on that basis, switching to natural gas was rejected as BACT for this application.

The use of the byproduct recovery desulfurization process in combination with the PROven® system, which is the next-highest ranked technically feasible control technology option for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from coking cycle COG combustion, was selected for this application.

#### **BACT Determination**

The proposed byproduct recovery desulfurization process in combination with the PROven® system represents BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control for C Battery coking cycle COG combustion.

The applicable H<sub>2</sub>S concentration limit of 10 gr/100 dcf is also proposed as a BACT requirement for the C Battery coking cycle COG combustion.

**Table 4-1 Top-Down Evaluation of BACT Options for C Battery Coking Cycle COG Combustion**

| Technology Option | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding | Reference |
|-------------------|-----------------------|---|------------------------------|---------|-----------|
|-------------------|-----------------------|---|------------------------------|---------|-----------|

**NO<sub>x</sub>**

|   |     |               |               |   |           |
|---|-----|---------------|---------------|---|-----------|
| PROven® system, byproduct plant removal of nitrogen compounds, and LNB-staged combustion system | Yes | No            | Not Evaluated | Selected as LAER and BACT                             | Page 4-10 |
| PROven® system and fuel switching to natural gas  | Yes | No            | Not Evaluated | Rejected, not as effective as selected control option | Page 4-10 |
| Fuel switching to blast furnace gas   | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-8  |
| Flue gas recirculation  | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-8  |
| Catalytic combustion systems  | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-9  |
| SCR   | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-9  |
| SNCR  | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-10 |
| Other post-combustion NO <sub>x</sub> emissions control technologies                            | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-10 |

**VOC and CO**

|  |     |               |               |   |           |
|--|-----|---------------|---------------|---|-----------|
| PROven® system                                   | Yes | No            | Not Evaluated | Selected as LAER and BACT                             | Page 4-12 |
| PROven® system and fuel switching to natural gas | Yes | No            | Not Evaluated | Rejected, not as effective as selected control option | Page 4-12 |
| Fuel switching to blast furnace gas              | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-11 |
| Oxidation catalyst                               | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                    | Page 4-11 |

**SO<sub>2</sub>**

|   |     |               |               |  |           |
|---|-----|---------------|---------------|--|-----------|
| PROven® system and fuel switching to natural gas      | Yes | Yes           | Not Evaluated | Rejected, higher NO <sub>x</sub> , VOC, and CO emissions | Page 4-14 |
| PROven® system and byproduct recovery desulfurization | Yes | No            | Not Evaluated | Selected as BACT   | Page 4-14 |
| Fuel switching to blast furnace gas                   | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                       | Page 4-13 |
| Flue gas desulfurization                              | No  | Not Evaluated | Not Evaluated | Rejected, not technically feasible                       | Page 4-13 |

**TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>**



| Technology Option  | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding  | Reference |
|--|-----------------------|---|------------------------------|--|-----------|
| PROven® system and fuel switching to natural gas               | Yes                   | Yes   | Not Evaluated                | Rejected, higher NO <sub>x</sub> , VOC, and CO emissions | Page 4-15 |
| PROven® system and byproduct recovery desulfurization          | Yes                   | No  | Not Evaluated                | Selected as BACT   | Page 4-15 |
| Fuel switching to blast furnace gas                            | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible                       | Page 4-15 |
| Flue gas emissions control, such as baghouse, ESP, or scrubber | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible                       | Page 4-15 |

### 4.3 BACT for C Battery Pushing

This section addresses BACT for all pushing emissions, including those that are captured and controlled by the PEC BH and fugitive emissions that escape capture by the PEC.

As indicated in **Table 2-1**, pushing emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

#### 4.3.1 Proposed C Battery Pushing Emissions Control Technologies

The proposed approach for the minimization of these emissions includes:

- Emissions of NO<sub>x</sub>, VOCs, CO, and SO<sub>2</sub> from pushing are controlled and minimized through proper heating, operating and work practices. The PROven® system will be a key component of the overall approach employed for minimizing these emissions.
- TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions will be minimized primarily through the PEC capture system and the PEC BH. The PEC capture system will achieve a capture efficiency of 90%, which is the maximum efficiency that technically feasible for this type of system. The control efficiency of the PEC BH will be more than 99%, equivalent to the highest efficiency level required for a coke oven battery pushing emissions control baghouse. As indicated in **Section 2.2.4**, one of the key attributes of the proposed C Battery system will be the Coke Transfer Car, which will be the first of its kind to be installed in the United States, which will reduce fugitive emissions during pushing by combining the functions of the coke-side door machine, coke guide, and pushing emissions capture hood. This makes it feasible to control the coke-side emissions from the time the oven door is removed until the push is complete and the quench car begins the traveling step. In addition the Coke Transfer Car represents an improvement in safety controls for workers versus a coke-side shed.

#### 4.3.2 BACT Baseline - Applicable Emissions Control Standards for Pushing Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for pushing are as follows:

- There are no NSPS applicable to coke oven pushing. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for pushing emissions, effective on April 14, 2006. §63.7290(a)(2) specifies a front-half particulate matter emissions limit of 0.02 pounds per ton of coke (lb/ton coke) from a control device applied to pushing emissions from a new or existing coke oven battery that employs a moveable hood vented to a stationary control device. §63.7290(b)(3) specifies that either the daily average fan motor amperes or the daily average volumetric flow rate at the inlet of the control device be maintained at or above the minimum level established during the initial performance test. Work practice standards are established to minimize visible emissions from pushing under §63.7291 (for byproduct coke oven batteries with vertical flues) and §63.7292 (for byproduct coke oven batteries with horizontal flues). §63.7300(b) and (c) require that written operating and maintenance plans for the coke oven as a whole and the pushing emissions capture and control system, respectively, be developed and followed to ensure the minimization of emissions. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.
- For NO<sub>x</sub>, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO<sub>x</sub> RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.
- For TSP, PM<sub>10</sub> and PM<sub>2.5</sub>, ACHD §2105.21(e) requires the installation of a pushing emissions control device. This section does not specify limits for new coke oven batteries. ACHD §2105.21(e)(1) specifies a limit of the higher of either 0.020 gr/dscf or as calculated through a formula presented in that subsection. However, ACHD §2105.21(e)(2) specifies a limit of 0.010 gr/dscf for Batteries 1 - 3, 7 - 9, and 19 at the Clairton Plant. ACHD §2105.21(e)(4) specifies limits on visible emissions for pushing and ACHD §2105.21(e)(6) specifies requirements specific to the Clairton Plant for ensuring that the PEC capture and control system is in place while pushing is done. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken. The limit of 0.010 gr/dscf for particulate matter emissions is the appropriate reference point for the BACT determination. The manufacturer has estimated an outlet grain loading of 0.005 gr/dscf for the C Battery PEC BH.

The proposed controls for the C Battery will comply in full with all of these applicable requirements.

#### 4.3.3 *State-of-the-Art for Emissions Control for Pushing Emissions*

As presented in **Appendix E-3**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to pushing emissions control are as follows:

- For all of the 45 byproduct recovery coke oven batteries and also for the 12 non-recovery coke oven batteries that are either currently in operation or (for Chicago Coke and the FDS Coke Plant) are expected to operate in the future in the United States, pushing emissions are captured by either (1) a shed enclosure vented to a control device, (2) a mobile capture and control unit, or (3) a traveling capture hood attached to a fixed duct venting to a control device. For all of these batteries, either a baghouse or a wet scrubber is employed to control captured pushing emissions.
- The only emissions control technologies identified for pushing emissions for any coke oven battery are for particulate matter emissions.
- C Battery will employ a moveable hood coupled with a baghouse to achieve an emissions level equivalent to or lower than 0.02 lb/ton coke for front-half particulate matter, and will meet an instantaneous visible emissions opacity limit of 20%. This will mean that for pushing emissions, C Battery will also be the best-controlled coke oven battery in the United States.

- For the 11 tall byproduct recovery coke oven batteries that were identified, the most stringent limits found are 0.02 lb/ton coke for particulate matter and 20% opacity for visible emissions. This is imposed on two of the batteries, and there is one other than is subject to limits of 0.03 lb/ton coke and 20% opacity. All three of those batteries employ the same moveable hood coupled with a baghouse emissions control system as will be employed by C Battery. B Battery at the Clairton Plant, which is the only tall byproduct recovery battery that employs a coke-side shed, is one of six tall byproduct recovery batteries to be required to meet the next-most stringent limit of 0.04 lb/ton coke (this is the limit for total particulate matter emissions; front-half emissions from B Battery are limited to 0.02 lb/ton), and unlike two of the other such tall byproduct recovery batteries, B Battery is also subject to the most stringent instantaneous opacity limit of 20%. It is noted here that the two tall byproduct recovery batteries that employ mobile scrubber cars are also subject to the limits of 0.04 lb/ton coke and 20% opacity; thus the available information indicates that similar control levels are achievable for any of the combinations of capture and control technologies that are employed. The Chicago Coke battery is one of the two that is subject to the 0.02 lb/ton coke limits, but as indicated previously, this unit has not yet been built and thus has not yet demonstrated compliance with its limits.
- For the 34 short byproduct recovery batteries, only one is required to meet limits of 0.03 lb/ton coke and 20% opacity. This battery employs a moveable hood coupled with a baghouse emissions control system. Batteries, 13, 14, 15, and 20 at the Clairton Plant are among 13 short byproduct recovery batteries required to meet the next-most stringent limits of 0.04 (total) lb/ton coke and 20% opacity (these are also total particulate matter emissions limits that are coupled a 0.02 lb/ton limit for front-half emissions). 17 short byproduct recovery batteries are subject to either a less stringent limit or no limit at all for particulate matter; five of those are subject to less stringent opacity limits; no information was found about the particulate matter limits for three of the other short byproduct recovery batteries. For the short byproduct recovery batteries, the information also indicates that similar control levels are achievable for any of the combinations of capture and control technologies that are employed.
- For the 11 non-recovery batteries, two are required to meet limits of 0.03 lb/ton coke and 20% opacity, and another four are required to meet limits of 0.04 lb/ton coke and 20% opacity. The two better-controlled batteries employ a moveable hood coupled with a baghouse emissions control system. Not surprisingly, the six non-recovery batteries that are not subject to a particulate matter emissions limit are also the six that employ coke-side sheds but no control devices.
- No information was found that indicated that limits are imposed on any coke oven batteries for pushing emissions of pollutants other than particulate matter and visible emissions.

#### **4.3.4 Top-Down Assessment of Control Technology Options for Pushing Emissions**

##### **4.3.4.1 BACT for NO<sub>x</sub>, VOC, and CO Emissions**

###### **Identification of Available Control Technology Options**

NO<sub>x</sub>, VOC, and CO emissions from pushing are attributable to the emission of COG remaining in the oven after the coking cycle has ended and the coke oven doors are removed. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all three pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for pushing emissions control, discussed in **Section 4.3.3**, there are no specific technologies identified as being in use for the control of emissions of NO<sub>x</sub>, VOCs, and CO from coke oven battery pushing operations. In general, minimization of these emissions involves employing operating practices that result in minimizing the amount of COG remaining in the oven after the coking cycle has ended. For the C Battery, the PROven® system will be a key component of the overall approach employed to accomplish this.

The following NO<sub>x</sub>, VOC, and CO emissions control technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system

#### **Technical Feasibility Assessment**

The PROven® system is technically feasible for this application. This system was developed specifically to address byproduct coke oven battery fugitive emissions, and as such it will reduce emissions generated during pushing because more of the COG will be removed from the ovens during the coking cycle.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, the PROven® system is the only available option identified for control of pushing emissions from C Battery, and this option is considered technically feasible for this application. This is the system that is proposed for C Battery.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

#### **BACT Determination**

The proposed combustion system design, featuring the PROven® system, represents both BACT and LAER for NO<sub>x</sub>, VOC, and CO emissions control for C Battery pushing emissions.

No specific NO<sub>x</sub>, VOC, or CO emissions limits are proposed as BACT for the C Battery pushing emissions. Since NO<sub>x</sub>, VOC, and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(4) represents the best means to ensure minimization of these emissions.

#### **4.3.4.2 BACT for SO<sub>2</sub> Emissions**

##### **Identification of Available Control Technology Options**

SO<sub>2</sub> emissions from pushing are attributable to the emission of COG remaining in the oven after the coking cycle has ended and the coke oven doors are opened.

For SO<sub>2</sub> emissions control, the technology options involve two elements. One is how the emissions will be captured, and the other is how the emissions that are captured will be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

##### ***Emissions Capture***

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

### *Emissions Control*

- SO<sub>2</sub> scrubber

### Technical Feasibility Assessment

A **coke-side shed** is technically feasible for this application. A coke-side shed offers the advantage of capturing not only pushing emissions but all of the coke-side fugitives, notably door leaks, which are not captured by conventional PEC capture hoods. However, a shed requires a significantly larger air handling system and control device (approximately twice that of the proposed system with twice the emissions). A shed is also not capable of as high a level of capture efficiency as are either of the other two pushing emissions capture system options, and therefore a shed is both much more costly and less cost-effective overall than either of the other two options. The achievable capture efficiency for a shed is limited. A major factor that limits the achievable capture efficiency for a shed is that the shed must have at least one open end to allow the quench car to travel to and from the quench tower. In addition to lower emissions capture, the experience with the shed installed on the Clairton Plant B Battery indicates several other significant drawbacks for this option. First, the following information shows that the costs for the coke-side shed are much higher than the costs for a traveling hood attached to a fixed duct and much higher costs.

- Purchased parts and services:.....\$600,000 for B Battery versus \$200,000 for a traveling hood/fixed duct system
- Labor:.....\$400,000 for B Battery versus \$200,000 for a traveling hood/fixed duct system
- Energy:.....\$756,000 for B Battery versus \$233,000 for a traveling hood/fixed duct system

It must be noted here that the cost data shown above are averages. The costs for the B Battery in the most recent years has been well above these averages. A second drawback (in addition to the limited achievable capture efficiency) for a coke-side shed that is known based on the experience with B Battery is that the maintenance requirements associated with a shed are more extensive than with either of the other two options. Third, the higher maintenance requirements for the shed result in much higher operating costs for B Battery than are experienced for the other batteries at the Clairton Plant that employ a traveling hood/fixed duct system. Fourth, although the B Battery baghouse is significantly larger than the control devices employed on the other batteries, it is the only device that has experienced failures in compliance demonstrations.

A **mobile capture and control unit** is not technically feasible for this application, because it is considered unlikely that a mobile capture and control unit employing a scrubber can meet the applicable ACHD emissions standards. A mobile capture and control unit offers the advantage of being able to capture and control traveling emissions, but this advantage will be outweighed by the superior overall capture and control efficiency and cost-effectiveness of the Coke Transfer Car that is proposed for this project. In fact, since it will capture emissions that escape when the oven doors are opened for pushing, the Coke Transfer Car will greatly reduce the fugitive emissions capture advantage of a coke-side shed. The mobile capture and control unit technology, equipped with scrubbers (referred to commonly as mobile scrubber cars), has been employed at other coke oven batteries owned and operated by U.S. Steel, and (as indicated above) at other batteries as well. According to pages 3-9 of the USEPA's BID, "mobile scrubber cars were popular in the 1970s but have for the most part been replaced by stationary systems." The reasons for this, as explained on pages 3-10 and 3-11 of USEPA's BID, included the high cost of operation and maintenance, the requirement of a heavy track to support the combined weight of the quench car and scrubber car, the creation of scrubber effluents that require treatment (in contrast to alternatives such as a baghouse where such is not created), limitation on accessibility for maintenance due to the need to mount equipment on mobile scrubber cars close together, and maintenance requirements associated with the diesel engine that is required to propel the gas cleaning car. Not included by USEPA in this regard are the emissions from and fuel costs associated with the diesel engine. The experiences at U.S. Steel with this type of technology were that they availability of the mobile scrubbing

cars was below expectations, and because as a mobile system the technology required the recycling of scrubbing water, the particulate level of that water was higher than would be used for a fixed-location scrubber, which resulted in lower overall control efficiency.

A **traveling hood attached to a fixed duct** is technically feasible for this application. Fixed duct systems involve either a belt-sealed duct or a dampered port mechanism employed to focus the vacuum to the moveable hood. No information was found that indicated any particular advantage of either option. However, according to page 3-4 of the USEPA's BID, the belt-sealed duct system "has emerged as the most functional and widely accepted method of controlling pushing emissions worldwide." Experience has also shown that the dampered hood systems are more adversely affected by distortion from the heat of the pushes (especially green pushes). That causes more spotting & sealing problems (and/or more maintenance and downtime) than with the belt-sealed systems.

An **SO<sub>2</sub> scrubber** is technically feasible for this application. A number of design options could be considered for this application, e.g., either a packed bed or spray tower could be used, and either sodium or calcium hydroxide could be used for scrubbing. The configuration that would most likely be employed would be to install the SO<sub>2</sub> scrubber following the PEC baghouse. However, this type of arrangement is not known to have been either applied, attempted, or even studied for a coke oven battery pushing emissions control system. The full scope of technical issues that may be associated with this type of arrangement is therefore completely unknown. As seen for other applications of air pollutant emissions control technologies, such as the employment of ESPs for coking cycle COG combustion emissions control, actual experience often reveals issues that are difficult to predict even when appreciable study has been done. Nevertheless, for the purpose of this BACT analysis, an SO<sub>2</sub> scrubber was considered technically feasible for this application.

#### Ranking of Technically Feasible Control Technology Options

As discussed above, of the available SO<sub>2</sub> emissions control options identified above, a coke-side shed and a traveling hood attached to a fixed duct are considered technically feasible for this application for emissions capture, and an SO<sub>2</sub> scrubber is considered technically feasible for this application for control of captured emissions. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing SO<sub>2</sub> emissions from C Battery pushing operations is to capture emissions using a traveling hood attached a fixed duct and vent the emissions to an SO<sub>2</sub> scrubber. As noted above, the most likely configuration for this application would be to install the SO<sub>2</sub> scrubber in series following the PEC baghouse. Of the available types of SO<sub>2</sub> scrubbers that could be considered for this application, the one that was judged to be capable of the highest level of SO<sub>2</sub> emissions reduction for this application is a packed-tower employing a dilute solution of sodium hydroxide; for the purposes of this BACT analysis this type of system was judged capable of achieving 90% reduction of (captured) SO<sub>2</sub> emissions, though as indicated above, there is no actual experience with this type of control application and therefore it is highly probable that this overestimates achievable control efficiency.

The next-most effective available option for minimizing SO<sub>2</sub> emissions from C Battery pushing operations is to capture emissions using a coke-side shed and vent the emissions to a packed-tower type SO<sub>2</sub> scrubber that employs a dilute solution of sodium hydroxide to achieve 90% reduction of captured SO<sub>2</sub> emissions. The same considerations discussed in the paragraph above regarding the type of system and estimated control performance apply to this option as well; since there is no actual experience with this type of control application and therefore it is highly probable that this overestimates achievable control efficiency.

The next-most effective available option for minimizing SO<sub>2</sub> emissions from C Battery pushing operations is to capture emissions using a traveling hood attached a fixed duct but not employ an SO<sub>2</sub> scrubber. For reasons explained below, this is the system that is proposed for the C Battery.

### **Top-Down Assessment of Technically Feasible Control Technology Options**

Although a scrubber would offer the advantage of combined SO<sub>2</sub> and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO<sub>2</sub> emitted during pushing (as compared to TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>), it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions. More specifically:

- An SO<sub>2</sub> scrubber of the type envisioned for this application (a packed-tower that employs a dilute solution of sodium hydroxide) would generate both a wastewater stream and solid waste that would require treatment and disposal, which constitutes an unacceptable environmental impact).
- Energy impacts with this technology would be even more significant and unacceptable. The packed-tower would add backpressure that would have to be overcome by employing a larger overall fan for the PEC system which by itself will mean that the energy requirements for the system will increase significantly. In addition, the larger fan size that will be needed will necessitate a larger-sized baghouse, meaning that the baghouse energy consumption will rise significantly. Finally, in addition to the energy consumed by the fan, additional energy will be required to power pumps to deliver reagent to the scrubber and carry away the scrubber effluent.
- The economic impact associated with an SO<sub>2</sub> scrubber was estimated on a rough order-of-magnitude basis - see **Appendix E-6**. It is noted here that this cost estimate was based on an application for which the energy costs were not nearly as significant as would be expected for this application. Nevertheless, as indicated, the cost of an SO<sub>2</sub> scrubber was estimated at more than \$11,000/ton of SO<sub>2</sub> reduction. This economic impact is clearly unacceptable for this application.

Because the associated environmental, energy, and economic impacts are considered unacceptable, employing an SO<sub>2</sub> scrubber was rejected as BACT for this application.

The capture of emissions without SO<sub>2</sub> scrubbing, which is the next-highest ranked technically feasible control technology option for SO<sub>2</sub> emissions from pushing operations, was selected for this application.

### **BACT Determination**

The proposed system involving capturing emissions using a traveling hood attached a fixed duct but not employing an SO<sub>2</sub> scrubber represents BACT for SO<sub>2</sub> emissions control for C Battery pushing operations.

No specific SO<sub>2</sub> emissions limit is proposed as BACT for the C Battery pushing emissions. Since SO<sub>2</sub> emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(4) represents the best means to ensure minimization of these emissions.

#### **4.3.4.3 BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> Emissions**

##### **Identification of Available Control Technology Options**

TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from pushing are attributable to generation of dust by the mechanical operation of pushing the hot coke from the oven into the quench car.

As discussed above in **Section 4.3.4.2** in regard to SO<sub>2</sub> emissions control, for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control, the technology options also involves how the emissions will be captured and how they will then be controlled. The technology options, including emissions control technologies applied to other types of

emissions units that could be considered for technology transfer to this application, were identified for evaluation:

#### ***Emissions Capture***

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

#### ***Emissions Control***

- Electrostatic precipitator
- Baghouse
- Particulate scrubber

#### **Technical Feasibility Assessment**

In regard to the technical feasibility of the three emissions capture system options, the findings are as discussed in **Section 4.3.4.2**.

In regard to the technical feasibility of the three emissions control system options, all three are technically feasible for this application. Strictly in terms of the achievable TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control efficiency, a baghouse is considered capable of a higher level of control than either an ESP or a scrubber.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control options identified above, a coke-side shed and a traveling hood attached to a fixed duct are considered technically feasible for this application for emissions capture, and an ESP, baghouse, and particulate scrubber are all considered technically feasible for this application for control of captured emissions. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

For emissions capture, for reasons discussed in **Section 4.3.4.2**, based on the experience with the B Battery at the Clairton Plant, the overall TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control efficiency that could be achieved by a traveling hood attached to a fixed duct is considered superior for this application to the efficiency that could be achieved by a coke-side shed.

For control of captured emissions, a baghouse is considered superior to either an ESP or a scrubber for removal of the type of particulate matter generated in pushing operations. An ESP would also have higher energy usage, maintenance requirements, and overall costs as compared to a baghouse. Although a scrubber could be designed to offer the advantage of combined SO<sub>2</sub> and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO<sub>2</sub> emitted during pushing, it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions.

The most effective available option for minimizing TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery pushing operations, therefore, is to capture emissions using a traveling hood attached to a fixed duct, which will then vent emissions to a baghouse. This is the system that is proposed for the C Battery.



Because, for reasons explained above, a coke-side shed, ESP, and scrubber will not result in lower TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions than will be achieved by using a traveling hood attached to a fixed duct coupled with a baghouse, these technologies were ranked below the proposed control technology and therefore were not assessed further in this analysis.

### Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

### BACT Determination

The proposed combination of a traveling hood attached to a fixed duct that will vent emissions to a baghouse represents BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control for C Battery pushing operations.

The following emissions limits for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions limit is proposed as BACT for the C Battery pushing operations:

- 0.02 lb/ton coke, front half
- 0.005 gr/dscf from the baghouse outlet

**Table 4-2 Top-Down Evaluation of BACT Options for C Battery Pushing Emissions**

| Technology Option  | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding  | Reference |
|--|-----------------------|---|------------------------------|--|-----------|
| <b>NO<sub>x</sub>, VOCs, and CO</b>  |                       |   |                              |  |           |
| PROven® system   | Yes                   | No  | Not Evaluated                | Selected as LAER and BACT  | Page 4-25 |
| <b>SO<sub>2</sub></b>  |                       |   |                              |  |           |
| Capture emissions with traveling hood attached to fixed duct, venting to an SO <sub>2</sub> scrubber | Yes                   | Yes   | Yes                          | Rejected, due to significant environmental, energy, and economic impacts | Page 4-23 |
| Capture emissions with coke-side shed, venting to an SO <sub>2</sub> scrubber                        | Yes                   | Yes   | Yes                          | Rejected, due to significant environmental, energy, and economic impacts | Page 4-23 |
| Capture emissions with traveling hood attached to fixed duct, with no SO <sub>2</sub> scrubbing      | Yes                   | No  | Not Evaluated                | Selected as BACT   | Page 4-23 |
| Capture emissions with coke-side shed, with no SO <sub>2</sub> scrubbing                             | Yes                   | No  | Not Evaluated                | Rejected, not as effective as selected control option                    | Page 4-23 |
| Capture emissions with mobile capture and control system (mobile scrubber car)                       | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible                                       | Page 4-21 |
| <b>TSP, PM<sub>10</sub>, and PM<sub>2.5</sub></b>  |                       |   |                              |  |           |

| Technology Option  | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding   | Reference |
|--|-----------------------|---|------------------------------|---|-----------|
| Capture emissions with traveling hood attached to fixed duct, venting to a baghouse  | Yes                   | No  | Not Evaluated                | Selected as BACT                                      | Page 4-25 |
| Capture emissions with traveling hood attached to fixed duct, venting to an ESP      | Yes                   | No  | Not Evaluated                | Rejected, not as effective as selected control option | Page 4-25 |
| Capture emissions with traveling hood attached to fixed duct, venting to an scrubber | Yes                   | Yes   | Not Evaluated                | Rejected, not as effective as selected control option | Page 4-25 |
| Capture emissions with coke-side shed, venting to a baghouse                         | Yes                   | No  | Not Evaluated                | Rejected, not as effective as selected control option | Page 4-25 |
| Capture emissions with coke-side shed, venting to an ESP                             | Yes                   | No  | Not Evaluated                | Rejected, not as effective as selected control option | Page 4-25 |
| Capture emissions with coke-side shed, venting to an scrubber                        | Yes                   | Yes   | Not Evaluated                | Rejected, not as effective as selected control option | Page 4-25 |
| Capture emissions with mobile capture and control system (mobile scrubber car)       | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible                    | Page 4-25 |

#### 4.4 BACT for C Battery Fugitives

This section addresses BACT for fugitive emissions that are generated during charging, decarbonization, soaking, and during the coking cycle due to leaks from coke oven doors, charging port lids, offtakes (at the connections to the ovens and at the standpipe caps), and the coke oven gas collection main. The BACT assessment for the C Battery fugitives that occur during pushing operations is discussed in **Section 4.3**. BACT for fugitive emissions generated during traveling is discussed in **Section 4.5**, and fugitive emissions generated in coke handling are addressed in **Section 4.7**.

As indicated in **Table 2-1**, the cited coke oven fugitive emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

##### 4.4.1 Proposed C Battery Fugitive Emissions Control Technologies

The proposed approach for the minimization of these emissions centers on the employment of the PROven® system, which represents the current state-of-the-art for minimizing coke oven fugitive emissions. Detailed information about the PROven® system is found in **Appendix D**. Beyond that, there are no other specific controls proposed to limit fugitive emissions of NO<sub>x</sub>, VOCs, CO, or SO<sub>2</sub>.

In addition to the PROven® system, controls that will be employed to minimize fugitive TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions will include the following:

- Charging emissions will be also minimized by the set of measures described in **Section 2.2.2**, which includes stage charging, which ensures that the oven is not overfed and that the feed rate of the coal permits capture by the exhaust system. The mechanisms that will be used to accomplish this include equipping the larry car with screw feeders and specially designed drop sleeves. Differences are also that

steam aspiration will not be required with the PROven® system (suction is provided by the negative pressure in the collector main) and C Battery will utilize a single collector main design.

- Leaks from oven doors, charging port lids, offtakes, and the gas collection main, which with the PROven® system will be lower than at other byproduct recovery coke oven batteries due to suction in the main, will be minimized through diligent operating and maintenance practices, including prompt luting of lids and offtakes, and effective cleaning of door jambs and seals after pushing. Door leaks will also be controlled by employing Flexed design flexible seals, which provide improved gas tightness relative to conventional types of metal door seals. In addition, fugitive emissions minimization will be enhanced by employing Uhde's CONTROLPRESS battery bracing system, which enables the required pre-stressing and gas tightness of the refractory walls of the ovens under varying operating conditions, and the Flexed design flexible seals that provide gas tightness for oven doors.

#### **4.4.2 BACT Baseline - Applicable Emissions Control Standards for Fugitive Emissions**

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for the cited coke oven fugitive sources, which are as follows:

- There are no NSPS applicable to coke oven fugitive emissions. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens Batteries, set forth in 40 CFR Part 63, Subpart L, sets standards for charging, top side, and door leaks, effective on December 31, 1995. §63.302 and §63.304 specify limits on the percentage of coke oven doors, offtakes, and lids that are leaking, and §63.304 specifies limits on the amount of time visible emissions occur during charging. C Battery fits the definition of a brownfield battery, therefore the following limits apply:

§63.302(d) limits      For coke oven batteries qualifying for the exemption under §63.302(c),  
                                  4.0% leaking doors  
                                  0.4% leaking top side lids  
                                  2.5% leaking offtakes  
                                  12 seconds of visible emissions per charge

§63.304(b)(3) limits    Effective after January 1, 2010, for a tall byproduct coke oven battery,  
                                  4.0% leaking doors  
                                  0.4% leaking top side lids  
                                  2.5% leaking offtakes  
                                  12 seconds of visible emissions per charge

These requirements apply to visible emissions. The NESHAPs does not, however, specify numerical limits for any regulated air pollutants.

§63.306 specifies that a written work practice plan be developed and followed to ensure the minimization of emissions. The regulation also specifies requirements for flaring bypass streams, for maintaining collection mains to ensure that leaks from those are minimized, and general, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures).

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for soaking emissions, effective on April 14, 2006. §63.7294 specifies work practice standards which require that a written plan be developed, and personnel trained to follow, a set of procedures to ensure the minimization of emissions, including certain specific procedures spelled out in this section. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.

- For NO<sub>x</sub>, VOCs, CO, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO<sub>x</sub> RACT regulations found in §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.
- While no ACHD standards are set for fugitive emissions of TSP, PM<sub>10</sub> and PM<sub>2.5</sub>, ACHD §2105.21(a) through (d) specifies limits for visible emissions from charging, door leaks, charging ports (top side lids), and offtakes, respectively. The specific requirements that apply to a new byproduct coke oven battery are as follows:

ACHD §2105.21(a)  
limits

5% leaking doors, excluding the two door areas of the last oven charged and any doors that are obstructed from view; the opacity of the visible emissions from door leaks may not exceed 40% at any time starting 15 minutes after charging has taken place  
1% leaking top side lids  
4% leaking offtakes  
55 seconds of visible emissions per any consecutive 5 charges

ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for the C Battery will comply in full with all of these applicable requirements.

#### **4.4.3 State-of-the-Art for Emissions Control for Fugitive Emissions**

As presented in **Appendix E-2**, relatively little information concerning the controls applied to coke oven battery fugitive emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. The most notable findings were as follows:

- For the 45 byproduct recovery coke oven batteries, the only fugitive emissions addressed are visible emissions.
- The only emissions control measures identified for fugitive emissions for any byproduct recovery coke oven battery are work practice requirements.
- To minimize charging fugitive emissions, many of the byproduct recovery coke ovens employ stage charging, a screw feed discharge mechanism, and automatic lid lifting. Several of the batteries are subject to limits on visible emissions for each charge and for consecutive charges.
- For leaks from doors, topside port lids, and offtakes, the most common emissions limit approach is to set a limit on the percentage of overall doors and lids that are generating visible emissions at a given point in time.

#### **4.4.4 Top-Down Assessment of Control Technology Options for Fugitive Emissions**

##### **Identification of Available Control Technology Options**

Fugitive emissions of NO<sub>x</sub>, VOC, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> from coke oven doors, charging port lids, offtakes, and the coke oven gas collection main are attributable to the emission of COG, coal dust, and coke dust from the oven during and after the coking cycle, before the coke oven doors are opened. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for pushing emissions control, discussed in **Section 4.4.3**, there are no other specific technologies identified as being in use for the control of fugitive emissions of NO<sub>x</sub>, VOC, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> from these elements of coke oven battery operations. By their nature, these types of emissions, and the techniques that can be applied to minimize them, are very case-specific. For the purposes of this assessment, however, the following technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- The PROven® system
- The Coke Transfer Car
- Additional capture and control
- Non-recovery coke oven battery design

#### **Technical Feasibility Assessment**

**The PROven® system** is technically feasible for this application. This system was developed specifically to address byproduct coke oven battery fugitive emissions, and represents a significant advancement in this state-of-the-art for byproduct coke oven batteries.

**The Coke Transfer Car** is technically feasible for this application. This system represents a significant advancement in the state-of-the-art for capturing fugitive emissions by quench cars.

**Additional capture and control** during pushing is not technically feasible for this application. As discussed by MACTEC Engineering and Consulting, Inc. in the July 2006 "Re-Evaluation of Reasonably Available Control Technology," this is not considered a feasible approach based on the substantial volume of air that would have to be collected to adequately capture the emissions, which in turn would yield a stream with such low pollutant concentration that control would not be either technically or economically feasible.

**Non-recovery coke oven battery design** is not technically feasible for this application. Theoretically, much but not all of the fugitive emissions generated during charging, soaking, and during the coking cycle can be eliminated by employing a non-recovery design because those types of ovens operate under negative, rather than positive pressure. Pushing, traveling, and quenching emissions, and fugitive emissions during decarbonization, would be the same for a non-recovery battery as they would be for a byproduct recovery battery. The potential advantage of lower fugitive emissions associated with a non-recovery coke oven battery design are more than outweighed, however, by the disadvantages for this application. In particular, because the Clairton Plant has state of the art byproducts recovery plant that produces clean COG, the overall amount of air emissions associated with a non-recovery design will be higher, perhaps significantly higher, than the emissions from the proposed C Battery. In a non-recovery coke oven battery, the raw COG is burned directly, resulting in higher emissions of NO<sub>x</sub>, SO<sub>2</sub>, and particulate matter than will be generated by the combustion of clean COG in the proposed C Battery. While the SO<sub>2</sub> can be controlled through flue gas desulfurization, based on the findings made in the permitting of each of the two non-recovery design plants in the United States (Indiana Harbor Coke in Indiana and Jewell Coal and Coke in Virginia) it will not be technically feasible to control the higher NO<sub>x</sub> or particulate matter emissions. In addition, since clean COG produced by the byproduct plant is used in place of natural gas throughout the Clairton Plant and at the Irvin and Edgar Thomson facilities, and since (as discussed previously) overall emissions are lower for clean COG combustion than for natural gas, employing a non-recovery design, rather than a byproduct design for the C Battery, will result in higher indirect emissions. Finally, since the byproduct plant produces materials such as tar, light oil, sulfur, and ammonia that are used at the facility and by outside customers, using a non-recovery design rather than a byproduct design will also result in higher indirect emissions attributable to manufacturing such materials rather than recovering them from the COG.

### Ranking of Technically Feasible Control Technology Options

As discussed above, of the available NO<sub>x</sub>, VOC, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control options identified above, the PROven® system and a Coke Transfer Car are considered technically feasible for this application for emissions capture. Additional emissions capture and a non-recovery coke oven battery design are not considered technically feasible for this application, and were not assessed further in this analysis.

The PROven® system coupled with a Coke Transfer Car is the top-ranked option for control of fugitive emissions for the C Battery. This is the system that is proposed for the C Battery.

### Top-Down Assessment of Technically Feasible Control Technology Options

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

### BACT Determination

The proposed combustion system design, featuring the PROven® system, coupled with the Coke Transfer Car, represents both BACT and LAER for NO<sub>x</sub>, VOC, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control for C Battery fugitive emissions.

No specific NO<sub>x</sub>, VOC, CO, or SO<sub>2</sub> emissions limits are proposed as BACT for the C Battery fugitive emissions. Since emission of these pollutants contributes to visible emissions, it is proposed that compliance with the following applicable visible emissions limits represents BACT for the C Battery fugitive operations, for all pollutants including those and for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>:

- 4.0% leaking doors
- 0.4% leaking top side lids
- 2.5% leaking offtakes,
- 12 seconds of visible emissions per charge

**Table 4-3 Top-Down Evaluation of BACT Options for C Battery Fugitive Emissions**

| Technology Option   | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding                            | Reference |
|---|-----------------------|---|------------------------------|------------------------------------|-----------|
| <b>NO<sub>x</sub>, VOCs, CO, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub></b> |                       |   |                              |                                    |           |
| PROven® system and Coke Transfer Car  | Yes                   | No  | Not Evaluated                | Selected as LAER and BACT          | Page 4-30 |
| Additional capture and control  | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible | Page 4-29 |
| Non-recovery battery design   | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible | Page 4-29 |

## 4.5 BACT for C Battery Traveling

As indicated in **Table 2-1**, traveling emissions consist primarily of particulate matter, but do contain other regulated air pollutants as well.

### 4.5.1 Proposed C Battery Traveling Emissions Control Technologies

There are no specific controls proposed for emissions from traveling. The quench car will be uncovered. However, as indicated in **Section 2.2.5**, the car will be larger than the one that is used for Batteries 7 - 9, and so even though more surface area will be exposed, the new car will emit less than the current car because it will have a lower surface area to volume ratio. Also as discussed, since C Battery will have substantially fewer ovens, and since the quench tower will be closer to those ovens than the current tower, shared by the three batteries, will be to those ovens, there will be far fewer trip-miles associated with the quenching operation for C Battery in comparison to the current operation.

### 4.5.2 BACT Baseline - Applicable Emissions Control Standards for Traveling Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for traveling are as follows:

- There are no NSPS applicable to coke oven traveling. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, does not set standards for traveling emissions because travel emissions are regulated as part of the push.
- For NO<sub>x</sub>, VOCs, and CO, there are no specific emissions control requirements or emissions limits specified under ACHD Article XXI. This includes the NO<sub>x</sub> RACT regulations found in ACHD §2105.06 or the specific source emissions and operating standards for coke ovens in ACHD §2105.21.
- While no ACHD standards are set for TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions from traveling, ACHD §2105.21(e)(5) specifies a visible emissions limit of 10%, applicable at all times, for traveling. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for the C Battery will comply in full with all of these applicable requirements.

### 4.5.3 State-of-the-Art for Emissions Control for Traveling Emissions

As presented in **Appendix E-3**, relatively little information concerning the controls applied to coke oven battery traveling emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. The most notable findings were as follows:

- For the 45 byproduct recovery coke oven batteries and also for the 11 non-recovery coke oven batteries, only visible emissions from traveling are addressed.
- No emissions control measures are identified for traveling emissions.
- In most cases, traveling emissions are limited in combination with pushing emissions, not separately. The Clairton Plant batteries are a notable exception to this. These are the most stringent limits that were found, 10% opacity. This same limit will be applied to C Battery.

#### **4.5.4 Top-Down Assessment of Control Technology Options for Traveling Emissions**

##### **4.5.4.1 BACT for NO<sub>x</sub>, VOC, and CO Emissions**

###### **Identification of Available Control Technology Options**

For NO<sub>x</sub>, VOC, and CO emissions from traveling, because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all three pollutants was addressed concurrently.

As indicated in the results of the examination of the current state-of-the-art for emissions control, discussed in **Section 4.5.3**, there are no specific technologies identified as being in use for the control of emissions of NO<sub>x</sub>, VOCs, and CO from coke oven battery traveling operations. In general, minimization of these emissions involves employing operating practices that result in minimizing the amount of time that the hot coke in the quench car is exposed to the air from when it is received in pushing to when it reaches the quench tower. Even more important in reference to minimizing these emissions are practices designed to minimize the amount of volatile material in the coke when it is pushed, i.e., minimizing production of "green coke."

Because no options could be identified for control of NO<sub>x</sub>, VOC, and CO emissions, no technology feasibility assessment, ranking of technically feasible control technology options, or top-down assessment of options was performed in this case.

###### **BACT Determination**

The proposed system design represents both BACT and LAER for NO<sub>x</sub>, VOC, and CO emissions control for C Battery traveling emissions.

No specific NO<sub>x</sub>, VOC, or CO emissions limits are proposed as BACT for the C Battery traveling emissions. Since NO<sub>x</sub>, VOC, and CO emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

##### **4.5.4.2 BACT for SO<sub>2</sub> Emissions**

###### **Identification of Available Control Technology Options**

For SO<sub>2</sub> emissions control, the technology options involve two elements. One is how the emissions will be captured, and the other is how the emissions that are captured will be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

###### ***Emissions Capture***

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")

###### ***Emissions Control***

- SO<sub>2</sub> scrubber



### Technical Feasibility Assessment

A **coke-side shed** is technically feasible for this application. A coke-side shed offers the advantage of capturing not only pushing emissions but all of the coke-side fugitives, notably door leaks, which are not captured by conventional PEC capture hoods. However, a shed requires a significantly larger air handling system and control device (approximately twice that of the proposed system with twice the emissions). A shed is also not capable of as high a level of capture efficiency as are either of the other two pushing emissions capture system options, and therefore a shed is both much more costly and less cost-effective overall than either of the other two options. The achievable capture efficiency for a shed is limited. A major factor that limits the achievable capture efficiency for a shed is that the shed must have at least one open end to allow the quench car to travel to and from the quench tower. In addition to lower emissions capture and much higher costs, the experience with the shed installed on the Clairton Plant B Battery indicates several other significant drawbacks for this option. The maintenance requirements associated with a shed are more extensive than with either of the other two options. Second, the higher maintenance requirements for the shed result in much higher operating costs for B Battery than are experienced for the other batteries at the Clairton Plant that employ a traveling hood/fixed duct system. Third, although the B Battery baghouse is significantly larger than the control devices employed on the other batteries, it is the only device that has experienced failures in compliance demonstrations.

A **mobile capture and control unit** is not technically feasible for this application, because it is considered unlikely that a mobile capture and control unit employing a scrubber can meet the applicable ACHD emissions standards. A mobile capture and control unit offers the advantage of being able to capture and control traveling emissions, but this advantage will be outweighed by the superior overall capture and control efficiency and cost-effectiveness of the Coke Transfer Car that is proposed for this project." In fact, since it will capture emissions that escape when the oven doors are opened for pushing, the Coke Transfer Car will greatly reduce the fugitive emissions capture advantage of a coke-side shed. The mobile capture and control unit technology, equipped with scrubbers (referred to commonly as mobile scrubber cars), has been employed at other coke oven batteries owned and operated by U.S. Steel, and (as indicated above) at other batteries as well. According to pages 3-9 of the USEPA's BID, "mobile scrubber cars were popular in the 1970s but have for the most part been replaced by stationary systems." The reasons for this, as explained on pages 3-10 and 3-11 of USEPA's BID, included the high cost of operation and maintenance, the requirement of a heavy track to support the combined weight of the quench car and scrubber car, the creation of scrubber effluents that require treatment (in contrast to alternatives such as a baghouse where such is not created), limitation on accessibility for maintenance due to the need to mount equipment on mobile scrubber cars close together, and maintenance requirements associated with the diesel engine that is required to propel the gas cleaning car. Not included by USEPA in this regard are the emissions from and fuel costs associated with the diesel engine. The experiences at U.S. Steel with this type of technology were that the availability of the mobile scrubbing cars was below expectations, and because as a mobile system the technology required the recycling of scrubbing water, the particulate level of that water was higher than would be used for a fixed-location scrubber, which resulted in lower overall control efficiency.

An **SO<sub>2</sub> scrubber** is technically feasible for this application. A number of design options could be considered for this application, e.g., either a packed bed or spray tower could be used, and either sodium or calcium hydroxide could be used for scrubbing. The configuration that would most likely be employed would be to install the SO<sub>2</sub> scrubber following the PEC baghouse.

### Ranking of Technically Feasible Control Technology Options

As discussed above, of the available SO<sub>2</sub> emissions control options identified above, a coke-side shed and an SO<sub>2</sub> scrubber are considered technically feasible for this application. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing SO<sub>2</sub> emissions from C Battery traveling operations is to capture emissions using a coke-side shed and vent the emissions to an SO<sub>2</sub> scrubber.

The next-most effective available option for minimizing SO<sub>2</sub> emissions from C Battery traveling operations is to employ no specific capture or emissions controls, but to ensure compliance with applicable visible emissions opacity standards, which (since SO<sub>2</sub> emissions contribute to visible emissions) represents minimization SO<sub>2</sub> emissions. For reasons explained below, this is the system that is proposed for the C Battery.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Employing a coke-side shed to capture emissions and then venting the emissions to an SO<sub>2</sub> scrubber represents the top-ranked SO<sub>2</sub> emissions control technology option for traveling emissions. As discussed previously, however, employing this type of system would mean that the proposed pushing emissions control system consisting of a traveling hood attached to a fixed duct vented to a baghouse would not be employed. The net result of that would be significantly higher overall emissions of TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> because emissions of particulate matter from pushing far exceed those from traveling. This is considered an unacceptable environmental impact, and on that basis, this option was rejected as BACT for this application.

The next-highest ranked technically feasible control technology option for SO<sub>2</sub> emissions from traveling is to ensure compliance with applicable visible emissions opacity standards. This was selected for this application.

#### **BACT Determination**

The proposed system involving no specific capture or emissions controls but ensuring compliance with applicable visible emissions opacity standards represents BACT for SO<sub>2</sub> emissions control for C Battery traveling operations.

No specific SO<sub>2</sub> emissions limit is proposed as BACT for the C Battery traveling operations. Since SO<sub>2</sub> emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

#### **4.5.4.3 BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> Emissions**

##### **Identification of Available Control Technology Options**

As discussed above in **Section 4.5.4.2** in regard to SO<sub>2</sub> emissions control, for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control, the technology options also involve how the emissions will be captured and how they will then be controlled. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

##### ***Emissions Capture***

- Coke-side shed
- Mobile capture and control unit ("mobile scrubber cars")
- Traveling hood attached to a fixed duct

##### ***Emissions Control***

- Electrostatic precipitator

- Baghouse
- Particulate scrubber

### **Technical Feasibility Assessment**

In regard to the technical feasibility of the three emissions capture system options, the findings are as discussed in **Section 4.5.4.2**.

In regard to the technical feasibility of the three emissions control system options, all three are technically feasible for this application. Strictly in terms of the achievable TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control efficiency, a baghouse is considered capable of a higher level of control than either an ESP or a scrubber.

### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control options identified above, a coke-side shed and an ESP, baghouse, and particulate scrubber are all considered technically feasible for this application. A mobile capture and control unit is not considered technically feasible for this application, and was not assessed further in this analysis.

For control of captured emissions, a baghouse is considered superior to either an ESP or a scrubber for removal of the type of particulate matter generated in pushing operations. An ESP would also have higher energy usage, maintenance requirements, and overall costs as compared to a baghouse. Although a scrubber could be designed to offer the advantage of combined SO<sub>2</sub> and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO<sub>2</sub> emitted during pushing, it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions.

The most effective available option for minimizing TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery traveling operations is to capture emissions using a coke-side shed and vent the emissions to an ESP, baghouse or particulate scrubber.

The next-most effective available option for minimizing TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery traveling operations is to employ no specific capture or emissions controls, but to ensure compliance with applicable visible emissions opacity standards, which (since TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions contribute to visible emissions) represents minimization TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions. For reasons explained below, this is the system that is proposed for the C Battery.

### **Top-Down Assessment of Technically Feasible Control Technology Options**

Employing a coke-side shed to capture emissions and then venting the emissions to an ESP, baghouse, or particulate scrubber represents the top-ranked TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control technology option for traveling emissions. As discussed previously, however, employing this type of system would mean that the proposed pushing emissions control system consisting of a traveling hood attached to a fixed duct vented to a baghouse would not be employed. The net result of that would be higher overall emissions of TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> because the proposed pushing emissions control system will be more efficient than a coke-side shed even when the traveling emissions capture aspect is included. The higher overall particulate emissions for the coke-side shed option is considered an unacceptable environmental impact, and on that basis, this option was rejected as BACT for this application.

The next-highest ranked technically feasible control technology option for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from traveling is to ensure compliance with applicable visible emissions opacity standards. This was selected for this application.

**BACT Determination**

The proposed system involving no specific capture or emissions controls but ensure compliance with applicable visible emissions opacity standards represents BACT for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control for C Battery traveling operations.

No specific TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions limit is proposed as BACT for the C Battery traveling operations. Since TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions contribute to visible emissions, it is proposed that compliance with the applicable visible emissions limits for pushing set forth in ACHD §2105.21(e)(5) represents the best means to ensure minimization of these emissions.

**Table 4-4 Top-Down Evaluation of BACT Options for C Battery Traveling Emissions**

| Technology Option  | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding  | Reference |
|--|-----------------------|---|------------------------------|--|-----------|
| <b>NO<sub>x</sub>, VOCs, and CO</b>  |                       |   |                              |  |           |
| No specific controls   | Yes                   | No  | Not Evaluated                | Selected as LAER and BACT  | Page 4-32 |
| <b>SO<sub>2</sub></b>  |                       |   |                              |  |           |
| Capture emissions with coke-side shed, venting to an SO <sub>2</sub> scrubber  | Yes                   | Yes   | Not Evaluated                | Rejected, higher overall C Battery TSP, PM <sub>10</sub> , and PM <sub>2.5</sub> emissions | Page 4-34 |
| No specific controls   | Yes                   | No  | Not Evaluated                | Selected as BACT   | Page 4-34 |
| Capture emissions with mobile capture and control system (mobile scrubber car) | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible   | Page 4-33 |
| <b>TSP, PM<sub>10</sub>, and PM<sub>2.5</sub></b>                              |                       |   |                              |  |           |
| Capture emissions with coke-side shed, venting to a baghouse                   | Yes                   | No  | Not Evaluated                | Rejected, higher overall C Battery TSP, PM <sub>10</sub> , and PM <sub>2.5</sub> emissions | Page 4-35 |
| Capture emissions with coke-side shed, venting to an ESP                       | Yes                   | No  | Not Evaluated                | Rejected, higher overall C Battery TSP, PM <sub>10</sub> , and PM <sub>2.5</sub> emissions | Page 4-35 |
| Capture emissions with coke-side shed, venting to an scrubber                  | Yes                   | Yes   | Not Evaluated                | Rejected, higher overall C Battery TSP, PM <sub>10</sub> , and PM <sub>2.5</sub> emissions | Page 4-35 |
| No specific controls   | Yes                   | No  | Not Evaluated                | Selected as BACT   | Page 4-36 |
| Capture emissions with mobile capture and control system (mobile scrubber car) | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible   | Page 4-35 |

#### 4.6 BACT for C Battery Quench Tower

As indicated in Table 2-1, quenching emissions consist of VOCs, SO<sub>2</sub> and particulate matter; the VOC consists of benzene-soluble organics, which are in particulate form.

##### 4.6.1 Proposed C Battery Quenching Emissions Control Technologies

The C Battery quench tower and settling basin will be designed with a state-of-the-art baffle system which will be the first of its kind to be installed in the United States. The system consists of louver-like baffles arranged in a chevron pattern. The baffles will contain the particulate/VOC emissions by mechanical deflection and electrostatic adsorption. This technology is not new, but it has been substantially improved by adding a second set of baffles. The lower set of baffles will be constructed from stainless steel, while the upper set will be constructed from polypropylene.

A second mist suppression spray, located just below the baffles, will help the dust particles suspended in the stream act as condensation cores around which droplets will form that will either precipitate on the louvers above, or descend downward. The quench tower will also be taller than the existing Battery 7 - 9 quench tower, in order to achieve the required draft for the second set of baffles. One other emissions reduction benefit of the new quench tower will be that it will replace the current auxiliary quench tower for B Battery, and thus to the extent it is used for that battery will represent a substantial improvement for emissions control.

##### 4.6.2 BACT Baseline - Applicable Emissions Control Standards for Quenching Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for quenching are as follows:

- There are no NSPS applicable to coke oven quenching. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for quenching emissions, effective on April 14, 2006. §63.7295(a)(1) specifies that either the concentration of total dissolved solids (TDS) concentration in the water used for quenching must not exceed 1,100 milligrams per liter (mg/L); or the sum of the concentrations of benzene, benzo(a)pyrene, and naphthalene in the water used for quenching must not exceed the applicable site-specific limit approved by the permitting authority. §63.7295(a)(2) specifies that makeup water must be acceptable (this term is not defined further in the regulation; it may be inferred that the makeup water should at least meet the same concentration requirements as specified above). §63.7295(b) specifies that the quench tower must be equipped with baffles, such that no more than 5 percent of the cross sectional area of the tower may be uncovered or open to the sky, and requires that the baffles must be washed daily when the tower is in use, except when ambient temperature remains less than 30°F throughout that day (if the measured ambient temperature rises to 30°F or more during the day, daily washing must be resumed). This also requires monthly inspection and the initiation of a repair or replacement effort within 30 days of discovery of damaged or missing baffles, to be completed as soon as practicable. §63.7300(b) requires that written operating and maintenance plans for the coke oven as a whole, including quenching, be developed and followed to ensure the minimization of emissions. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.
- ACHD §2105.21(g) specifies the employment of a baffled quench tower using water that "is equivalent to, or better than, the water quality standards established for the nearest stream or river by regulations promulgated by the DEP under Pennsylvania Clean Streams Law, Act of June 22, 1937.

The proposed controls for the C Battery will comply in full with all of these applicable requirements, with the clarification stated in the compliance certification under ACHD §2104.02(h), that "make-up water is equivalent to, or better than, the water quality standards established for the Monongahela River by regulations promulgated by the DEP under the Pennsylvania Clean Streams Law, ... except that water from the Monongahela River may be used" for such make-up."

#### **4.6.3 State-of-the-Art for Emissions Control for Quenching Emissions**

As presented in **Appendix E-4**, the key findings made based on the information found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR relative to quenching emissions control are as follows:

- For the 33 quench towers serving byproduct recovery and non-recovery coke oven batteries that are either currently in operation or (for Chicago Coke and the FDS Coke Plant) are expected to operate in the future in the United States, as required under NESHAPs, all control quenching emissions by equipping the towers with baffles, limiting the total dissolved solids (TDS) level of the quench water, and adhering to a specified schedule for baffle inspections and cleaning.
- The only emissions control technologies identified for pushing emissions for any coke oven battery are for particulate matter emissions. No information was found that indicated that limits are imposed on any coke oven batteries for quenching emissions of pollutants other than particulate matter and visible emissions.
- The proposed C Battery quench tower design and associated operating and maintenance procedures will be equivalent or superior to those employed at the best-controlled quench towers in the United States.

#### **4.6.4 Top-Down Assessment of Control Technology Options for Quenching Emissions**

##### **Identification of Available Control Technology Options**

VOC, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from quenching are attributable to generation of dust by the mechanical operation of depositing the large volume of water on the coke.

The nature of the quenching operation, involving periodic bursts of a large volume of water-saturated air containing relative low levels of entrained particulate matter, precludes the consideration of the ESPs, scrubbers, and baghouses that are used for other (even large-scale) sources of particulate emissions. The technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- Tall tower with chevron baffle design
- Dry quenching

##### **Technical Feasibility Assessment**

A **tall tower with a chevron baffle design** is technically feasible for this application. The Low Emission Quench (LEQ) was designed to meet the particulate emissions standard for dry quenching in Germany while avoiding the issues associated with dry quenching (as discussed below).

**Dry quenching** is not technically feasible for this application. A dry quenching system involves substituting an inert gas such as nitrogen for water for cooling the coke. According Chapter 10 of to STAPPA/ALACO's March 2006 report "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options," "some plants in Europe have switched from water quenching to dry quenching to limit emissions of PM and VOCs," but "[T]his does require major construction activities and associated costs." More specifically, the "European

Commission (EC) estimates that a dry quenching plant may cost between 10 and 15 times more than a wet quenching station." As stated on pages 137 to 139 of the EC's December 2001 report entitled "Integrated Pollution Prevention and Control (IPPC) Best Available Techniques Reference Document on the Production of Iron and Steel," dry quenching processes were generally "intended for application in coke oven plants located in regions which suffer from long periods of severe cold, such as for example: Siberia, Finland, Poland, where wet quenching of coke is difficult or even impossible."

In reference to the CDQ type dry quenching system, USEPA's BID notes that "[T]here are no visible emissions" and that "heat from the hot coke is recovered with minimum operating costs". The USEPA's BID also discusses the Kress Indirect Dry Cooling system that was demonstrated at the Bethlehem Steel Corporation Sparrows Point mill in 1991, which reportedly "looks promising for the reduction of pushing and quenching emissions" (while not stated by USEPA, this would also be a means of controlling traveling emissions), but that the demonstration identified some problems with the technology that were not resolved while it was being tested. A search of the open literature did not identify a single case in which the Kress technology has been applied other than the cited demonstration at Sparrows Point, and therefore it cannot be considered as an available option for this application.

A documented instance of the commercial application of Coke Dry Quenching (CDQ) can be found at the Kaiserstuhl Coke Plant in Dortmund, Germany. Stoppa et al., 1999<sup>10</sup> discuss the relative merits and demerits of dry quenching observed at this facility. According to studies conducted at this plant, the dust emissions (PM emissions) range from 15-50 g/ton coke for a wet quenching system compared to 1-20 g/ton coke for a dry quenching system. While this exhibits a clear advantage of the dry quenching system as opposed to the wet quenching system for abatement of PM emissions, the same study showed that dry quenching process results in significantly higher quantities of gaseous pollutants such as SO<sub>2</sub> and CO. This fact makes it difficult to identify the better of the two technologies.

For those and possibly other reasons, the CDQ process at the Kaiserstuhl plant was shut down: the Kaiserstuhl plant itself was shut down subsequent to the discontinuation of the CDQ process. There are in fact no other dry quenching plant is known to be in operation at this time in Europe. As indicated above, the LEQ tall wet quenching tower design featuring chevron-style baffles was developed for plants such as Kaiserstuhl to meet the same emissions limits as were met by dry quenching but without the other detriments.

Another obvious concern regarding dry quenching is that while this will reduce water consumption for a coke oven battery by a significant amount, this advantage may be outweighed by the associated raw material consumption and other system demands of a CDQ as well as the attendant indirect emissions.

The establishment of a dry quenching process at Clairton would require a large area of real estate which is not available in the current scenario.

Also, coke dry quenching process requires a backup wet quenching process during occurrences of downtime and there is an increased risk of powdering and combustion of the coke during dry quenching thus decreasing the coke yield.

Moreover, the cost benefit ratio comparison conducted at Kaiserstuhl revealed that whereas a CDQ system can be installed at \$60-\$90 per annual ton coke produced, a wet quenching system accomplishes the same task at less than a quarter of the value (\$15 per annual ton coke produced). The cost of labor and material amount to \$13 million for CDQ compared to \$5 million for a wet quenching system. Furthermore, revisions of CDQ (that occur every 3 years) cost another \$2.5 million whereas no such revisions are required for a wet quenching system.

Dry quenching of coke facilitates the recovery of the sensible heat of coke and uses that energy to make steam which can be traded to earn proceeds. As such, a clear determinant of the profitability of the coke plant employing dry quenching lies in the domestic prices of energy. In countries such as Japan, where energy

prices are high, it is more cost effective to have a CDQ system. In the U.S.A, where energy prices are much lower, wet quenching systems make for more profitable operations.

Considering the level of emissions that will be associated with the C Battery quenching operation, the significantly higher costs that would be associated with employing a dry quenching system make this unacceptable choice in this case. For these reasons, employing a dry system design as a means to reduce quenching emissions was rejected as BACT for this application.

#### **Ranking of Technically Feasible Control Technology Options**

As discussed above, of the available VOC, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control options identified above, a wet quenching system featuring a tall tower design with chevron style baffles is considered technically feasible for this application. A dry quenching system is not considered technically feasible for this application, and was not assessed further in this analysis.

The most effective available option for minimizing VOC, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions from C Battery quenching operations, therefore, is to employ a wet quenching system featuring a tall tower design with chevron style baffles. This is the system that is proposed for the C Battery.

#### **Top-Down Assessment of Technically Feasible Control Technology Options**

Because the top-ranked technically feasible control option was selected, no further analysis of control technology options was conducted.

#### **BACT Determination**

The proposed wet quenching system featuring a tall tower design with chevron style baffles represents LAER and BACT for VOC, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions control for C Battery quenching operations.

The following emissions limits for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions limit is proposed as BACT for the C Battery quenching operations:

- 5% maximum of tower cross-sectional area left uncovered or open to the sky,
- 1,100 mg/L TDS in quenching makeup water

**Table 4-5 Top-Down Evaluation of BACT Options for C Battery Quenching Emissions**

| Technology Option   | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding                            | Reference |
|---|-----------------------|---|------------------------------|------------------------------------|-----------|
| <b>VOCs, SO<sub>2</sub>, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub></b> |                       |   |                              |                                    |           |
| Wet quenching, with a tall tower design and chevron-style baffles       | Yes                   | No  | Not Evaluated                | Selected as BACT and LAER          | Page 4-40 |
| Dry quenching   | No                    | Not Evaluated                               | Not Evaluated                | Rejected, not technically feasible | Page 4-38 |

#### **4.7 BACT for C Battery Coke Handling**

As indicated in **Table 2-1**, coke handling emissions consist of particulate matter only.



#### **4.7.1 Proposed C Battery Coke Handling Emissions Control Technologies**

As indicated in **Section 2.2.7**, emissions from coke handling will be minimized by applying a surfactant to suppress dust formation, and the employment of a new baghouse to be installed on a new Screening Station. The new screening station will be permitted separately.

#### **4.7.2 BACT Baseline - Applicable Emissions Control Standards for Coke Handling Emissions**

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for traveling are as follows:

- There are no NSPS applicable to coke handling. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery.
- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, does not set standards for coke handling.
- For VOCs, there is no specific emissions control requirement or emissions limit specified under ACHD Article XXI.
- For TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions, ACHD §2104.02(b) specifies limits on general process source particulate emissions of "seven (7) pounds in any 60 minute period or 100 pounds in any 24-hour period, except that no person subject to the requirements of this Subsection b shall be required to reduce emissions to a greater degree than 99 percent." ACHD §2104.02(f) specifies a source-specific PM<sub>10</sub> emissions limit of 2.8 gr/ton coke for No. 3 Screening Station. This limit has recently been found to be in error and a revision has been proposed by ACHD, gone through the required public comment period and is currently in front of Allegheny County Council for approval. ACHD §2104.05 specifies that emissions from materials handling operations must not be visible beyond the property line. ACHD §2105.21 does not specify emissions control requirements or emissions limits for coke handling. ACHD §2105.40 specifies that visible emissions from material transportation within permitted source facilities cannot be visible at or beyond the property line of such source, have an opacity of 20% or more for a period or periods aggregating more than three (3) minutes in any 60 minute period, or have an opacity of 60% or more at any time. ACHD §2105.49 specifies that "all reasonable actions to prevent fugitive emissions from becoming airborne" must be taken.

The proposed controls for C Battery will comply in full with all of these applicable requirements.

#### **4.7.2 State-of-the-Art for Emissions Control for Coke Handling Emissions**

Little information concerning the controls applied to coke handling emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. From the information that was obtained, it is clear that baghouses are the exclusive technology employed to control emissions from coke screening operations, and that other potential sources of fugitive emissions from coke handling are minimized through diligent work practices.

### 4.7.3 Top-Down Assessment of Control Technology Options for Coke Handling Emissions

#### Identification of Available Control Technology Options

There are no technologies beyond those that are proposed for coke handling emissions that can be considered for this application.

Because no options could be identified, no technology feasibility assessment, ranking of technically feasible control technology options, or top-down assessment of options was performed in this case.

#### BACT Determination

The proposed system design represents BACT for TSP, PM<sub>10</sub> and PM<sub>2.5</sub> emissions control for C Battery coke handling emissions.

The following emissions limits for TSP, PM<sub>10</sub>, and PM<sub>2.5</sub> emissions limit is proposed as BACT for the C Battery coke handling operations:

- 7 lbs/60 minute period, or
- 100 lbs/24-hour period,
- not to exceed 99% control

**Table 4-6 Top-Down Evaluation of BACT Options for C Battery Coke Handling Emissions**

| Technology Option   | Technically Feasible? | Significant Environmental or Energy Impact? | Significant Economic Impact? | Finding          | Reference |
|---|-----------------------|---|------------------------------|------------------|-----------|
| <b>TSP, PM<sub>10</sub>, and PM<sub>2.5</sub></b>                     |                       |   |                              |                  |           |
| Effective work practices and baghouse control of screening operations | Yes                   | No  | Not Evaluated                | Selected as BACT | Page 4-42 |

### 4.8 BACT Determination Summary

The review of the RBLC and California's BACT Clearinghouse identified no listings for BACT or LAER determinations for coke oven battery emissions controls, including control of coke handling emissions. A summary of the most relevant information found regarding limits on coke handling emissions is presented in **Table 4-7**.

Table 4-7 Summary of Best Available Control Technology for C Battery

| Pollutant                                 | Emissions Control Technology  | BACT Emissions Levels   |
|---|---|---|
| <b>Coking Cycle COG Combustion</b>        |   |   |
| NO <sub>x</sub>                           | PROven® system, staged combustion, byproduct recovery plant removal of nitrogen-containing organic compounds  | No specific limit   |
| VOCs                                      | PROven® system, effective combustion  | No specific limit   |
| CO  | PROven® system, effective combustion  | No specific limit   |
| SO <sub>2</sub>                           | PROven® system, byproduct recovery plant desulfurization  | 10 gr/dcf H <sub>2</sub> S content in treated COG   |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | PROven® system, byproduct recovery plant desulfurization  | 0.015 gr/dscf, 10 gr/dcf H <sub>2</sub> S content in treated COG  |
| <b>Pushing</b>                            |   |   |
| NO <sub>x</sub>                           | PROven® system, effective work practices  | No specific limit   |
| VOCs                                      | PROven® system, effective work practices  | No specific limit   |
| CO  | PROven® system, effective work practices  | No specific limit   |
| SO <sub>2</sub>                           | PROven® system, effective work practices  | No specific limit   |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | PROven® system, Coke Transfer Car, moveable hood with belt-sealed fixed duct, baghouse, achieving 90% capture efficiency and 99% control efficiency | 0.02 lb/ton coke.<br>0.010 gr/dscf  |
| <b>Fugitives</b>                          |   |   |
| NO <sub>x</sub>                           | PROven® system, effective work practices  | No specific limit   |
| VOCs                                      | PROven® system, effective work practices  | No specific limit   |
| CO  | PROven® system, effective work practices  | No specific limit   |
| SO <sub>2</sub>                           | PROven® system, effective work practices  | 500 ppmvd   |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | PROven® system, Coke Transfer Car   | 4.0% leaking doors<br>0.4% leaking top side lids<br>2.5% leaking offtakes,<br>12 seconds of visible emissions per charge<br>20% instantaneous opacity from push via VEO |
| <b>Traveling</b>                          |   |   |

| Pollutant                                 | Emissions Control Technology | BACT Emissions Levels |
|---|------------------------------|-----------------------|
| NO <sub>x</sub>                           | Effective work practices     | No specific limit     |
| VOCs                                      | Effective work practices     | No specific limit     |
| CO  | Effective work practices     | No specific limit     |
| SO <sub>2</sub>                           | Effective work practices     | No specific limit     |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | Coke Transfer Car            | 10% Opacity via VEO   |

| Quenching                                 |  |   |
|---|--|---|
| NO <sub>x</sub>                           | Effective work practices   | No specific limit   |
| VOCs                                      | Effective work practices   | No specific limit   |
| CO  | Effective work practices   | No specific limit   |
| SO <sub>2</sub>                           | Effective work practices   | No specific limit   |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | State-of-the-art tower and baffle design, employ clean quenching water, daily cleaning of baffles, monthly inspection of baffles | 5% maximum of tower cross-sectional area left uncovered or open to the sky,<br>1,100 mg/L TDS in quenching makeup water |

| Coke Handling                             |   |  |
|---|---|--|
| NO <sub>x</sub>                           | Effective work practices  | No specific limit  |
| VOCs                                      | Effective work practices  | No specific limit  |
| CO  | Effective work practices  | No specific limit  |
| SO <sub>2</sub>                           | Effective work practices  | 500 ppmvd  |
| TSP, PM <sub>10</sub> , PM <sub>2.5</sub> | Effective work practices and baghouse control of screening operations | 7 lbs/60 minute period, or 100 lbs/24-hour period, not to exceed 99% control except as specified in a unit-specific BACT determination |

#### 4.9 References

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